SELECTED WATER RESOURCES ABSTRACTS

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A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 9, NUMBER 19
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W76-10001 -- W76-10404

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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For primary bibliographic entry see Field 5C.
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For primary bibliographic entry see Field 2L.
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CANADIAN PARTICIPATION IN THE INTERNATIONAL HYDROLOGICAL DECADE, FINAL REPORT, (VOLUME 2), RESEARCH REPORTS.
International Hydrological Decade, Ottawa (Ontario). Canadian National Committee.
Research Reports, Inland Waters Directorate, Environment Canada, Ottawa, Canada, 240 p, append.

Descriptors: *International Hydrological Decade, *Canada, *Research and development, *Programs, Hydrology, Surface runoff, Groundwater, Lakes, Geomorphology, Snow, Ice, Glaciers, Water quality, Surface waters, Meteorology, Education, Soils, Publications, Information exchange.
Identifiers: *Research projects, International Cooperation.

The International Hydrological Decade (IHD) 1965-1974, was launched by the General Conference of UNESCO at its 13th session to promote international cooperation in research and studies, and the training of specialists, in scientific hydrology. Promotion of collaboration in advancing hydrological research techniques, disseminating hydrological data and planning hydrological installations were features of the IHD program. Highlights of research projects conducted in Canada under the IHD program are outlined. (Environment Canada).
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2C. Snow, Ice, and Frost

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CH2M/Hill, Corvallis, Oreg. Wastewater Reclamation.
For primary bibliographic entry see Field 5D.
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INFORMATION BOOKLET FOR ICEREF, THE BIBLIOGRAPHY OF CANADIAN GLACIERS, GLACIER INVENTORY NOTE NO. 8,
Department of the Environment, Ottawa (Canada). Inland Waters Directorate.
C. S. L. Ommanney, and J. W. Clarkson.
Report Series No. 27, 1973, 123 p.

Descriptors: *Glaciers, *Bibliographies, Ice, Snow, Avalanches, Permafrost, Geomorphology, Sea ice, Lake ice, Icebergs, Water temperature, Depth, Measurement, Water balance, *Canada.
Identifiers: Weighting factors, Ice crystals, Atmospheric ice, Ground ice, River ice, Energy balance, Glacier fluctuations.

A description is presented of the procedures to be followed in listing references, for inclusion in ICEREF, the Bibliography of Canadian Glaciers, by author, date, title and source. A list of the Index Concepts or key words, used to describe the references, is given. Retrieval and sorting are possible on all or any of these Index Concepts so that bibliographies may be prepared for a single author, for a glacier, for a region or for a particular subject matter; restrictions may be imposed by the use of weighting factors. Samples of the output obtained, based on some 400 entries to date, are given. The Monitor List, a mirror image of the punched card input, is used for cross-referencing and corrections. The General Index demonstrates the sorting capabilities available. The Thesaurus contains all the Index Concepts used, and, thus, is an indication of the approved vocabulary. Part (1) describes the various parts of the Data Sheet and gives instructions for coding and the use of weighting factors. Part (2) contains an updated version of the Thesaurus. Part (3) lists the American Society for Testing and Materials (ASTM) CODEN for most of the journals likely to be searched. Part (4) contains a complete list of all Canadian Glacier names, their inventory number, if available, and their location, as well as the names of glaciers from several other countries. A list of glacier types has been appended to Part (4) to aid coders in the comparison of other glacier classifications with that recommended by UNESCO/IASH for the glacier inventory. (Environment Canada)
W76-10494

APPROACH TO GLACIER MASS-BALANCE ANALYSIS UTILIZING TERRAIN CHARACTERIZATION,
Department of the Environment, Ottawa (Canada). Inland Waters Directorate.
G. J. Young.
Water Resources Branch, Scientific Series No. 60, 1976, 34 p. 11 fig., 41 ref., 2 tab.

Descriptors: *Glaciers, *Measurement, *Mass, Water resources, Maps, Hydrology, Snow, Basins, Depth snowmelt, Data, Snowpacks, Ablation, Methodology, *Canada, Terrain analysis, Computer programs.
Identifiers: Terrain, Snow accumulation, Data analysis, *Glacier mass-balance analysis.

A description is presented of a method currently being used to produce accumulation, ablation, and net balance maps as part of the mass balance studies on selected glaciers in Western Canada. The method uses associations between snow depth and terrain geometry to extrapolate the measurements made at sampling locations to unvisited parts of the glacier. The grid square technique has proved very efficient for computer manipulation of data bases and for calculations and tabulations of results. The rationale behind the method and instructions for implementation, including a program listing, are presented. Although the system has been developed for Canadian Cordilleran conditions, the approach could be used with equal success on glaciers with substantially different surface geometry characteristics. (Environment Canada)
W76-10499

2D. Evaporation and Transpiration

DIFFUSION AND MASS FLOW OF NITRATE-NITROGEN TO PLANT ROOTS,
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W76-10182

A MODEL OF WATER CONTENT AND EVAPORATION FOR HARDWOOD LEAF LITTER,
Western Carolina Univ., Cullowhee, N.C. Dept. of Biology.
A. Moore, and W. T. Swank.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, p 58-69. 3 fig, 1 tab, 21 ref, (CONF-740513).

Descriptors: *Evaporation, *Model studies, *Hydrologic aspects, Litter, Deciduous forests, North Carolina.
Identifiers: *Forest litter, Coweeta Watershed(NC).

A predictive model of water content and evaporative losses in the litter of a mixed deciduous forest is described. The model uses readily obtainable data on total daily incoming solar radiation, rainfall, mean daytime temperature, and mean daytime relative humidity. The model also requires data on site latitude, slope, and aspect; initial litter accumulation; annual quantity and timing of leaf fall; and transmission of solar radiation through the canopy. Three hydrologic compartments are defined--atmosphere, litter, and soil--and one biomass compartment--the litter dry weight. Only two of the intercompartmental flows are modeled--evaporation from litter to atmosphere and drainage from litter to soil. Evaporation rates are calculated from a modified Penman formula but are limited by the vapor conductivity of the litter. The model incorporates throughfall and litter-decay functions. Model performance was tested against independent data collected at the Coweeta Hydrologic Laboratory, North Carolina. The simulated evaporation over 8- and 12-day periods in summer and winter agreed with measured evaporation to within 13%. Daily values of litter water content were usually within the error limits of experimental data. Simulated evaporation and litter water content over an 80-day period also showed good agreement with experimental data. (See also W76-10266) (Auen-Wisconsin)
W76-10270

WATER EXPENDITURE ON TRANSPIRATION BY PLANTS COMMUNITIES DOMINANT IN EASTERN KARA KUM, (IN RUSSIAN),
P. D. Gunin, and V. P. Dedkov.
'Probl Osvoeniya Pustyn'. 3, p 58-61, 1974.

Descriptors: *Transpiration, Plant populations, *Desert plants, *Shrubs, Seasonal, *Evapotranspiration.
Identifiers: Ephedra-strobilacea, Haloxylon-aphyllum, Haloxylon-persicum, *USSR(Kara Kum).

Observations were made on the intensity of transpiration of the dominant desert shrubs (USSR). Haloxylon persicum, H. aphyllum and Ephedra strobilacea show the most intense transpiration. The rate of evapotranspiration was calculated with respect to total night transpiration. In Haloxylon aphyllum communities, the intensity of transpiration in summer exceeds that in H. persicum communities, 1895 m3/ha and 237 m3/ha, respectively.--Copyright 1975, Biological Abstracts, Inc.
W76-10341

2E. Streamflow and Runoff

INTERPRETATION OF INTERNAL TRACER EXPERIMENTS AND LOCAL SOJOURN TIME DISTRIBUTIONS,
City Coll., New York. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W76-10039

SELECTED STREAMFLOW EXPERIENCE GRAPHS FOR SOUTHWESTERN PENNSYLVANIA,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 7C.
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PRINCIPLES AND MEASURING TECHNIQUES OF TURBULENCE CHARACTERISTICS IN OPEN-CHANNEL FLOWS,
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 8B.
W76-10134

HYDROLOGIC DATA FOR URBAN STUDIES IN THE FORT WORTH, TEXAS METROPOLITAN AREA, 1974,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
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For primary bibliographic entry see Field 7C.
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Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
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HYDROLOGIC DATA FOR NORTH CREEK TRINITY RIVER BASIN, TEXAS, 1974,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W76-10147

HYDROLOGIC UNIT MAP--1974, STATE OF WASHINGTON.
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 7C.
W76-10150

MINIMIZATION OF CORE REQUIRED IN ROUTING THROUGH A CHANNEL NEWTWORK,
Hydrocomp International, Palo Alto, Calif.
J-J. Heler.
Simulation Network Newsletter, (Hydrocomp), Vol. 7, No. 7, p 1-8, October 1, 1975. 16 fig, 2 ref.

Descriptors: *Analytical techniques, *Computer models, *Data storage and retrieval, Computers, *Simulation analysis, Channel flow, Routing, Reach(Streams).
Identifiers: Tree structures.

A method has been discussed for decreasing the computer core requirement for simulation of channel networks for a simple case of flow routing. Most natural watersheds are arranged in networks, which are arbitrary sets of channels, reservoirs, and diversion points logically connected in a tree structure. The tree structure is divided into reaches which are computational elements receiving inflow and producing outflow. The order of the reaches upstream from a given point does not matter, when using a routing algorithm. For each reach of the network, a routing algorithm assembles the cumulated outflows from all tributaries, computes the local inflows, and computes outflows. Before these computations are made on any reach, they must be made on all of its tributaries. Within this requirement there are several ways to analyze a tree structure, with varying requirements for computer data storage. One such method, 'Theseus traversing', involves starting with the leftmost reach that has no tributaries and proceeding downstream as far as possible, then moving to the next reach to the right with no tributaries and proceeding downstream as far as possible. When the tree structure is properly ordered, this method requires the least computer data storage. The optimum way to order the tributaries is to sort them according to the order. A reach with no tributaries has order 0; a reach with one tributary has order one and other reaches have the same order as their tributary with the highest order or an order higher by one if two tributaries both have the highest order. A formula is given for determining the core requirement in terms of buffers needed to analyze a tree structure with a given number of reaches. These methods are also applicable to quality constitutents and sediment routing, but only in tree structures. (Snyder-FIRL)
W76-10243

2F. Groundwater

CHANGE IN DRAWDOWN CAUSED BY ENLARGING A WELL IN A DOLOMITE AQUIFER,
Geological Survey, Columbus, Ohio. Water Resources Div.
For primary bibliographic entry see Field 4B.
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TACOMA'S NORTH FORK WELLS.
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W76-10089

ELECTRICAL WATER PROSPECTING.
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DIGITAL MODEL FOR SIMULATED EFFECTS OF GROUND-WATER PUMPING IN THE HUECO BOLSON, EL PASO AREA, TEXAS, NEW MEXICO, AND MEXICO,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 4B.
W76-10140

NATIONAL WATER DATA STORAGE AND RETRIEVAL SYSTEM: INSTRUCTIONS FOR PREPARATION AND SUBMISSION OF GROUND-WATER DATA,
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 10D.
W76-10148

MAPS SHOWING GROUND-WATER CONDITIONS IN THE RANEGRAS PLAIN AND BUTLER VALLEY AREAS, YUMA COUNTY, ARIZONA--1975,
Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 7C.
W76-10149

ANALOGOUS MODELLING OF AQUIFEROUS SYSTEMS IN COASTAL ZONES,
Akademiya Nauk SSSR, Moscow. Interagency Geophysical Committee.
For primary bibliographic entry see Field 2L.
W76-10455

PROGRAM ESOPH - EXTENDED SOPH, SIMULATION OF TIME-VARIANT PIEZOMETRIC SURFACE IN A CONFINED, LEAKY AQUIFER SUBJECTED TO PUMPING.
Department of the Environment, Ottawa (Canada). Inland Waters Directorate.
For primary bibliographic entry see Field 7C.
W76-10498

2G. Water In Soils

PHOSPHORUS DISTRIBUTION FROM SEPTIC TANK EFFLUENT IN COASTAL PLAIN SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W76-10015

PUDDLING TROPICAL RICE SOILS: 2. EFFECTS OF WATER LOSSES,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W76-10118

RESULTS OF INFILTRATION TESTS NEAR SCOTT CITY, WESTERN KANSAS,
Geological Survey, Lawrence, Kans.
J. B. Gillespie, and G. D. Hargadine.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-252 242, $4.00 in paper copy, $2.25 in microfiche. Water-Resources Investigations 76-12, April 1976. 29 p, 22 fig, 5 tab, 18 ref.

Descriptors: *Infiltration rates, *Soils, *Loess, *Infiltrometers, *Kansas, Methodology, Data collections, Soil properties, Soil structure, Hydraulic conductivity, Instrumentation.
Identifiers: Western Kansas, Richfield soil.

The purpose of this investigation was to evaluate the infiltrometer as a reconnaissance tool for estimating long-term infiltration rates of water into the loessial soils of western Kansas. Infiltration rates determined from the different types of ring infiltrometers were not consistent, but the tests showed that substantial quantities of water could infiltrate the Richfield soil. Average daily infiltration rates in the soil ranged from 3 to 5 feet using 22-inch ring infiltrometers; 2.3 feet using a 10-inch ring infiltrometer; and from 1.3 to 2.2 feet using double-ring infiltrometers. By comparison, the average daily infiltration rate in the loess using a 10-inch ring infiltrometer was about 13 feet. Laboratory tests of a soil core indicated that the lowest hydraulic conductivity was in the depth interval from 3.9 to 8.6 inches. Soil in this interval, which coincides with the depth of cultivation, evidently limits the rate of infiltration. Air-permeability tests of the unsaturated zone indicated low hydraulic conductivities of 1.9 and 0.2 feet per day for the depth intervals from 0 to 5 feet and 57 to 75 feet respectively. The conductivity of the lower interval probably would create a perched water table during prolonged infiltration. (Woodard-USGS)
W76-10136

DIFFERENT LEVELS OF SOIL ORGANIC MATTER IN DESERT SOIL AND NITROGEN FERTILIZER ON YIELDS AND MINERAL COMPOSITION OF BARLEY GROWN IN THE SOIL,
California Univ., Los Angeles. Div. of Environmental Biology.
For primary bibliographic entry see Field 3F.
W76-10170

ANOMALOUS DIURNAL PATTERNS OF STEM XYLEM WATER POTENTIALS IN LARREA TRIDENTATA,
New Mexico State Univ., University Park. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W76-10172

DIFFUSION AND MASS FLOW OF NITRATE-NITROGEN TO PLANT ROOTS,
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
R. E. Phillips, T. NaNagara, R. E. Zartman, and J. E. Leggett.
Agronomy Journal, Vol. 68, No. 1, p 63-66, January-February, 1976. 2 fig, 1 tab, 11 ref.

Descriptors: *Soil-water-plant relationships, *Diffusion, *Soil water movement, *Nitrogen, *Nitrates, *Root systems, Transpiration, Nutrient requirements, Model studies, Flow, Moisture content, Absorption, Model studies, Path of pollutants, Corn(Field).
Identifiers: Mass flow, *Nitrate-nitrogen.

A model for estimating nitrate-nitrogen uptake by plant roots is developed and its application discussed. Soil and plant parameters which must be known in order to predict transport by diffusion and mass flow include volumetric soil water content, NO3-N concentration in soil solution, porous diffusion coefficient of soil NO3-N, average soil water macroscopic velocity at the plant root surface, root radius, transpiration rate and plant root length. A previously reported steady-state model for simultaneous mass flow and diffusion is evaluated with reference to measurement of those parameters. The importance of diffusion to mass flow is great when the ratio of transpiration rate to the constant of proportionality relating flux into the plant to NO3-N concentration in soil solution is less than 0.2. (Jahns-Arizona)
W76-10182

YIELD-NUTRIENT ABSORPTION RELATIONSHIPS AS AFFECTED BY ENVIRONMENTAL GROWTH FACTORS,
National Fertilizer Development Center, Muscle Shoals, Ala.
For primary bibliographic entry see Field 2I.
W76-10184

INTERACTION OF WATER POTENTIAL AND TEMPERATURE EFFECTS ON GERMINATION OF THREE SEMI-ARID PLANT SPECIES,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2I.
W76-10185

CHARACTERISTICS OF THE ACCUMULATION OF FREE AMINO ACIDS BY SOME NONSPORULATING BACTERIA FROM TYPICAL IRRIGATED SIEROZEM, (IN RUSSIAN),
Akademiya Nauk Uzbekskoi SSR, Tashkent. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W76-10188

EFFECT OF WATER REGIME ON PRODUCTIVITY OF CULTIVATED PLANTS, (IN BELORUSSIAN),
For primary bibliographic entry see Field 3F.
W76-10189

PERCOLATION TESTS FOR SEPTIC TANK SUITABILITY IN SOUTHERN ARIZONA SOILS,
Arizona Univ., Tuscon. Dept of Soils, Water, and Engineering.
For primary bibliographic entry see Field 5D.
W76-10248

NUMERICAL ANALYSIS OF ONE-DIMENSIONAL WATER INFILTRATION,
Hawaii Univ., Honolulu. Water Resources Research Center.
E. D. H. Cheng.
Available from the National Technical Information Service, Springfield, Va., 22161, as PB-255 184, $4.50 in paper copy, $2.25 in microfiche. Technical Report No. 92, June 1975. 44 p, 14 fig, 28 ref, append. OWRT A-035-HI(1), 14-31-0001-3811, 14-31-0001-4011, 14-31-0001-5011.

Descriptors: *Finite element analysis, *Infiltration, *Hawaii, *Numerical analysis, Equations, *Soil moisture, Moisture content, Model studies, Soil profiles, Diffusivity, Hydraulic conductivity, *Soil water movement.
Identifiers: *Hawaiian Latosols, Continuous System Modeling Program, *Moisture profiles(Soils), *Moisture diffusivity(Soils).

In attempting to numerically solve the nonlinear moisture flow equation, the Galerkin process, which bears a great similarity to direct methods of the calculus of variations, and the Continuous System Modeling Program (CSMP) approach have been employed. In the finite element formulation of the governing equation, systems of nonlinear algebraic equations were developed on the basis of linear two-dimensional triangular element. These nonlinear algebraic equations were solved simultaneously, at each step, by a programmed logic of iterations. In the CSMP approach, Boltzmann's function application and layered soils formulation were employed in obtaining horizontal and vertical moisture profiles. The second and third degrees of polynomial interpretations of moisture diffusivity, D(theta), and hydraulic conductivity K(theta), of the media were conducted. However, it was established that the former representation had only very limited applicability (as far as some Hawaiian soils are concerned) because a second degree polynomial can accurately describe the D(theta) and K(theta) functions only of the wetter portion of the D(theta) and K(theta) vs. moisture content, Theta, curves. The finite element, CSMP, and finite difference solutions were investigated and compared for Wahiawa soils with lateral moisture movement. Vertical moisture profiles for the Molokoi soils and Tantalus silty clay loams were also investigated by means of the finite element method and the CSMP approach, respectively.
W76-10262

FREQUENCY DISTRIBUTIONS OF RADIOCESIUM CONCENTRATIONS IN SOIL AND BIOTA,
Savannah River Ecology Lab., Aiken, S.C.
For primary bibliographic entry see Field 5B.
W76-10273

RADIOCESIUM CYCLING IN VEGETATION AND SOIL,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W76-10296

CERIUM AND COBALT MOVEMENT WITH LITTER LEACHATE IN A FOREST SOIL,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W76-10311

BASE-LINE DATA ON EVERGLADES SOIL-PLANT SYSTEMS: ELEMENTAL COMPOSITION, BIOMASS, AND SOIL DEPTH,
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
For primary bibliographic entry see Field 5C.
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EFFECTS OF CLEAR-CUTTING ON NUTRIENT LOSSES IN ASPEN FORESTS ON THREE SOIL TYPES IN MICHIGAN,
Michigan Univ., Ann Arbor. School of Natural Resources.
For primary bibliographic entry see Field 4C.
W76-10315

MOBILIZATION OF NUTRIENTS IN SOIL BY ACIDS OF SULFUR AND CHELATING AGENTS,
California Univ., Los Angeles, Lab., of Nuclear Medicine and Radiation Biology.
For primary bibliographic entry see Field 5B.
W76-10316

CHANGE OF WATER REGIME AND CONTENT OF MOBILE FORMS OF N, K, MN AND FE IN MEADOW-PEAT SOIL OF THE RAMENSK FLOODPLAIN OF THE MOSCOW RIVER IN CONNECTION WITH AGRICULTURAL USE, (IN RUSSIAN),
Nauchno-Issledovatelskii Institut Ovoshchnogo Khozyaistva, Moscow (USSR).
V. A. Shtern.
Biol Nauki (Mosc). 18(3), p 110-116, 1976.

Descriptors: *Soil-water-plant relationships, Groundwater, *Soil moisture, Analysis, Moisture content, Irrigation effects, Nitrogen, Iron, Potassium, Manganese, Fertilizers, *Flood plains.
Identifiers: Ramensk, *Moscow River(USSR).

The groundwater level on fields of the Ramensk Sovkhoz in the floodplain of the Moscow River (USSR) drops by the end of the growing season. The maximum soil mositure content was noted at a high groundwater level and the minimum at a low level. The weather conditions and irrigation cause substantial changes of soil moisture. At maximum soil moisture content the content of N, Fe and K compounds increases, and at a low moisture content it decreases. The use of mineral fertilizer with Mo on the soil increases the content of mobile N, K, Fe and Mn compounds. The content of these elements in the soil depends on the amount of ferrous oxide in the soil and uptake of these elements by plants.--Copyright 1976, Biological Abstracts, Inc.
W76-10477

EFFECT OF TILLAGE ON SOIL STRUCTURE AND PLANT GROWTH UNDER RAIN-FED CONDITIONS,
Indian Agricultural Research Inst., New Delhi.
S. Mallick, and Y. N. Nagarajarao.
Indian J Agric Sci. 42(9), p 827-831, 1972.

Descriptors: *Soil-water-plant relationships, *Soil compaction, Compaction, *Corn(Field), Crops, Analysis, *Cultivation, *Chiselling, *Deep tillage, Farm management, Crop response, Rain water, Loam, *Plant growth.

Under rain-fed conditions on a sandy-loam soil on which maize (Zea mas L.) was grown, chiseling, plowing with a moldboard plow, discing, and plowing with a local (desi) plow were compared for tillage efficiency. The depth-wise root distribution was determined at flowering. The bulk density at various stages of growth, moisture-retention characteristics at flowering, hydraulic conductivity at compacted minimum bulk density, settling percentage and aggregation at harvesting stage were determined. The yield differences were statistically significant. Chiseling gave the highest yield. Positive correlations existed between yield and quantity of roots and also available moisture in the subsoil, both being highest under chiseling. The bulk density very rapidly returned to the original value with heavy showers after plowing. The hydraulic conductivity at compacted minimum bulk density followed the root-distribution pattern. Chiseling increased the settling percentage at lower depth, and the aggregation

decreased. Planting of deep-rooted crops and deep placement of fertilizers help build up stable soil structure in the subsoil.--Copyright 1974, Biological Abstracts, Inc.
W76-10487

2H. Lakes

POPULATION CHARACTERISTICS OF A SPECIES ENSEMBLE OF WATERBOATMEN (CORIXIDAE),
Rochester Univ., N. Y. Dept. of Biology.
C. A. Istock.
Ecology 54(3), p 535-544, 1973.

Descriptors: *Spatial distribution, *Ponds, Michigan, *Temporal distribution, *Growth rates, Breeding.
Identifiers: Competition, *Corixidae, Hesperocorixa-lobata, Sigara-macropala, *Waterboatmen.

The spatial and temporal distributions of 12 spp. of waterboatmen in a 1.2 ha pond in Northern Michigan were studied for 3 consecutive summers. Enclosure experiments involving the growth of 1, 2, and 3 corixid species were performed to test for interspecies competitive interactions and to determine whether the dominant species reach the upper limits to population growth. The experimental data indicate that interspecific competition between the 2 dominant species, Hesperocoriza lobata and Sigara macropala, in enclosures led to a significant reduction in the population size of H. lobata but not of S. macropala. From the enclosure experiments it appears that H. lobata failed to grow to its maximum limit because of competition, while S. macropala did reach its limit, at least in late summer. The experiments also showed that the early summer and late summer breeding habits of H. lobata and S. macropala, respectively, are not physiologically (genetically) fixed properties of these species. It is suggested that the corixid species ensemble here studied may be characterized as 2 sets of ecological homologues: 1 set of Hesperocorixa species that breeds early in the summer and 1 set of Sigara species that breeds later.--Copyright 1973, Biological Abstracts, Inc.
W76-10123

A MATHEMATICAL MODEL OF BLOOMS OF PLANKTON DIATOMS, (IN GERMAN),
Deutsche Akademie der Wissenschaften zu Berlin (East Germany). Forschungsstelle fuer Umweltgestaltung.
For primary bibliographic entry see Field 5C.
W76-10127

RECONNAISSANCE DATA ON LAKES IN WASHINGTON--VOLUME 6. ADAMS, BENTON, DOUGLAS, FRANKLIN, GRANT, LINCOLN, WALLA WALLA, AND WHITMAN COUNTIES,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 7C.
W76-10138

RECONNAISSANCE DATA ON LAKES IN WASHINGTON--VOLUME 7. PEND OREILLE, SPOKANE, AND STEVENS COUNTIES,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 7C.
W76-10139

GREAT LAKES POLLUTION CLEANUP STAGNATES AS PROBLEMS MOUNT,
For primary bibliographic entry see Field 5G.
W76-10250

STRENGTHENING LAKE-SHORELAND MANAGEMENT IN MASSACHUSETTS,
Massachusetts Univ., Amherst, Water Resources Research Center.
For primary bibliographic entry see Field 6E.
W76-10264

BORON AND ARSENIC STUDIES IN FLORIDA WATERS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5B.
W76-10265

A SPECIFIC-ACTIVITY AND CONCENTRATION MODEL APPLIED TO CESIUM MOVEMENT IN AN OLIGOTROPHIC LAKE,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 5C.
W76-10275

THE ROLE OF EMERGENT MACROPHYTES IN MINERAL CYCLING IN A FRESHWATER MARSH,
Wisconsin Univ., Milwaukee. Dept. of Botany,
For primary bibliographic entry see Field 5C.
W76-10289

CHANGES IN WATER CHEMISTRY AND PRIMARY PRODUCTIVITY OF A REACTOR COOLING RESERVOIR (PAR POND),
DuPont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
For primary bibliographic entry see Field 5C.
W76-10290

NUTRIENT LOSSES IN PARTICULATE FORM AS WEIR POND SEDIMENTS FROM FOUR UNIT WATERSHEDS IN THE SOUTHERN APPALACHIANS,
Georgia Univ., Athens. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W76-10330

THE EFFECT OF URBAN LAND USE ON NUTRIENT AND SUSPENDED-SOLIDS EXPORT FROM NORTH FLORIDA WATERSHEDS,
Florida State Univ., Tallahassee. Dept. of Oceanography.
For primary bibliographic entry see Field 4C.
W76-10331

NUMERICAL MODEL FOR STORM SURGE AND TIDAL RUN-UP STUDIES,
Dames and Moore, Los Angeles, Calif. Advance Technology Group.
For primary bibliographic entry see Field 2L.
W76-10456

MACROZOOBENTHOS OF WATER BODIES OF THE KHAZARASP REGION OF THE KHOREZM OBLAST, (IN RUSSIAN),
S. Embergenov.
Uzb Biol Zh. 18(3), p 41-43, 1974.

Descriptors: *Benthos, Lakes, Taxonomy, Diptera, Mayflies.
Identifiers: Hemiptera, Khazarasp, Khorezm, Oblast, Odonata, *USSR(Uzbek-SSR), *Zoobenthos.

Morphological and hydrological characteristics of the waters of the lakes Dunguzuldy, Khassa, Davrokh, Yumalandy and Akkul in the Khazarasp region in the Uzbek SSR (USSR) and the qualitative composition of macrozoobenthos in them are discussed. The macrozoobenthos was composed of 23 spp. in 8 taxonomic groups and 3 types. The larvae of Chironomidae (11 spp.), Odonata (4 spp.), Ephemeroptera and Hemiptera (2 spp. each) made up 52.5%.--Copyright 1975, Biological Abstracts, Inc.
W76-10476

EXCHANGE FLOW BETWEEN LAKE ONTARIO AND HAMILTON HARBOUR,
Canada Centre for Inland Waters,Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W76-10496

APPLICABILITY OF THE TECHNICON AUTOANALYZER I AND II SYSTEMS FOR SHIPBOARD ANALYSIS OF GREAT LAKES WATER SAMPLES,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W76-10497

2I. Water In Plants

COMPETITION AND THE RELATIVE ABUNDANCES OF TWO CLADOCERANS,
Maryland Univ., College Park. Dept. of Zoology.
J. D. Allan.
Ecology. 54(3), p 484-498, 1973.

Descriptors: Algae, *Competition, *Crustaceans, Daphnia, Bacteria, Detritus, *Predation, Mortality, Aquatic animals.
Identifiers: Carbon-14, Chaoborus, *Daphnia-parvula, *Holopedium-gibberum.

Two cladocerans, Daphnia parvula and Holopedium gibberum, were studied to determine whether the species were competing and whether the observed coexistence was predictable from competitive relationships alone. Experimental manipulations of intra- and inter-specific competition using 14C-labeled algae, bacteria, and detritus revealed clear competitive effects only with algae. Some resource partitioning was demonstrated. A model was proposed specifying Holopedium to be the poorer competitor for mutually shared resources, but also to be less reliant on those mutual resources, owing to its larger niche. This model predicts coexistence and a higher relative abundance for Holopedium. However, the dynamics of field populations did not correspond to this prediction. Daphnia was rare and declining throughout the study whereas Holopedium exhibited a prenounced burst of growth. Analysis of birth and death processes revealed that Holopedium was relatively free from mortality throughout most of the study, while Daphnia suffered death rates of 20% day or higher. This differential mortality explains the discrepancy between the competition model and observed densities. Finally, field studies indicated that mortality of Daphnia owing to predation by Chaoborus larvae is more than twice that of Holopedium. Daphnia and Holopedium could coexist in a purely competitive system; however, because of selective predation, their observed abundances correspond little to their competitive status.--Copyright 1973, Biological Abstracts, Inc.
W76-10125

ANOMALOUS DIURNAL PATTERNS OF STEM XYLEM WATER POTENTIALS IN LARREA TRIDENTATA,
New Mexico State Univ., University Park. Dept. of Biology.
J. P. Syvertsen, G. L. Cunningham, and T. V. Feather.
Ecology, Vol. 56, No. 6, p 1423-1428, Autumn 1975. 1 tab, 7 fig, 18 ref.

Descriptors: *Soil-water-plant relationships, *Creosote, *Xylem, *Soil water movement, *Soil moisture, New Mexico, Water vapor, Transpira-

tion, Soil profiles, Root zone, Stemflow, Thermocline, Soil temperature, Shrubs.

At a study area in northeast Dona Ana County, New Mexico, diurnal stem xylem water potentials of Larrea tridentata (DC.) Cov. were measured with a pressure chamber during the summers of 1973 and 1974. Plants growing in dry soils had minimum water potentials at night and maximum values during the day, possibly due to vertical water vapor movements in the soil profile in response to temperature gradients. Water vapor apparently moves up from the rooting zone at night and drops again during the day. This process probably enhances the ability of Larrea shrubs to maintain photosynthetic activity when soil water potentials are low. Daily stem xylem water potentials may exceed the predawn value by as much as 35 bars and reach midday levels similar to well-watered plants. Midday values will probably begin exceeding predawn values when the latter fall to between -32 and -43 bars; this range is likely to vary according to soil type and climatic conditions. (Jahns-Arizona)
W76-10172

TECHNIQUES FOR IMPROVING TREE SURVIVAL AND GROWTH IN SEMIARID AREAS,
Agricultural Research Service, Manhattan, Kans.
J. D. Dickerson, N. P. Woodruff, and E. E. Banbury.
Journal of Soil and Water Conservation, Vol. 31, No. 2, p 63-66, March-April, 1976. 3 fig, 4 tab, 38 ref.

Descriptors: *Scotch pine trees, *Juniper trees, *Plant growth, Soil-water-plant relationships, *Semiarid climates, Environmental effects, Microenvironment, Water harvesting, Irrigation effects, Mulching, Water management(Applied), Windbreaks.
Identifiers: *Redcedar trees(Juniperus virginia), *Tree survival, Snowfence protection, Shade treatment, Soil profile modification.

Seven techniques were tested for supplying more water or altering the microclimate of eastern redcedar (Juniperus Virginiana) and Scotch pine (Pinus sylvestris) planting sites to improve survival and growth. Water-harvesting treatments (50 x 100 and 50 x 50 feet areas) provided 40 and 30 percent more redcedar growth than the control; drip irrigation and snowfence protection improved growth by 35 and 33 percent respectively. Survival increased with those techniques and with shade treatment, the latter having no positive influence on growth. Scotch pines responded less to the same treatments but survived and grew best with snowfence protection and drip irrigation. Soil profile modification and mulch plot treatments were unsuccessful; no Scotch pines survived under those techniques. Results indicate that trees in semiarid regions can be brought more rapidly to effective wind-barrier heights. (Jahns-Arizona)
W76-10175

EFFECT OF LOW MOISTURE LEVEL ON CATALASE ACTIVITY IN SOME CROP PLANTS DURING JUVENILE PHASE,
Gujarat Univ., Ahmedabad (India). Botany Div.
A. B. Vora, H. C. Patel, A. V. Vyas, B. R. Patel, and J. A. Patel.
Annals of Arid Zone, Vol. 14, No. 3, p 229-234, September 1975. 3 tab, 14 ref.

Descriptors: *Moisture stress, *Germination, *Crops, *Soil-water-plant relationships, *Plant tissues, Corn(Field), Plant physiology, Enzymes, Embryonic growth stage, Water requirements, Seeds, Legumes.
Identifiers: *Catalase activity.

After seeds of maize (Cv. Ganga 5), gram (Cv. Chafa) and Sesamum (Cv. Patan 64) were germinated under 'adequate' and 'low' moisture levels, catalase activity was determined in the growing axis and in maize endosperm, gram cotyledons, and Sesamum seedlings every 24 hours for 4 days. Low moisture levels caused catalase activity declines in the growing axis of maize and gram seedlings and gram cotyledon, while the endosperm enzymic activity of maize was unaffected. Enzymic activity of Sesamum seedlings increased at 24 and 72 hours and decreased at 48 hours of germination. The embryo axis of adequately watered seedlings showed greatly increased catalase activity for 72 hours followed by a decline. At a low moisture level, catalase activity remained low until a sharp rise occurred approaching 96 hours. Activity was much greater in the axis than the cotyledon, but low moisture levels depressed both. (Jahns-Arizona)
W76-10178

YIELD-NUTRIENT ABSORPTION RELATIONSHIPS AS AFFECTED BY ENVIRONMENTAL GROWTH FACTORS,
National Fertilizer Development Center, Muscle Shoals, Ala.
G. L. Terman, F. E. Khasawneh, S. E. Allen, and O. P. Engelstad.
Agronomy Journal, Vol. 68, No. 1, p 107-111, January-February, 1976. 7 fig, 17 ref.

Descriptors: *Plant growth, *Nutrients, *Crop production, *Soil temperature, *Soil environment, Nitrogen, Phosphorus, Corn(Field), Oats, Growth rates, Root development, Soil management, Crop response, Absorption.

Temperature effects on crop yield-nutrient concentration and uptake relationships were evaluated in three greenhouse pot experiments and as reported in the literature on such factors. Several rates of applied nitrogen and phosphorus were compared in experiments on oats grown for 7 weeks at three combinations of day length and temperature; corn grown for 4 weeks at water bath temperatures of 16 and 27C; and corn grown for 3 and 6 weeks to compare P rates and temperatures of 16 and 21 C and at ambient temperatures (25 to 35C). Plant nutrient concentrations, especially of P, increase with greater soil temperatures in short-duration experiments, with little yield response to temperature. Where marked yield response occurs, dilution of plant nutrient concentrations but higher uptake are the dominant trends with temperature increases up to the optimum for each crop species; the opposite trend usually occurs at temperatures above the optimum. Substrate nutrient release under higher temperatures varies with the soil fertility level and amounts of applied nutrients. Root growth rate is probably important in uptake, especially with nutrients having limited mobility in the soil. (Jahns-Arizona)
W76-10184

INTERACTION OF WATER POTENTIAL AND TEMPERATURE EFFECTS ON GERMINATION OF THREE SEMI-ARID PLANT SPECIES,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
M. L. Sharma.
Agronomy Journal, Vol. 68, No. 2, p 390-394, March-April, 1976. 2 fig, 1 tab, 16 ref.

Descriptors: *Osmotic pressure, *Germination, *Temperature, *Soil moisture, Planting management, Semiarid climates, Environmental effects, Moisture stress, Thermal stress, *Australia, Grasses, Shrubs, Viability.
Identifiers: *Water potential, *Matric potential, *Osmotic potential, New South Wales.

The interactive effects of temperature with matric and osmotic potential on the germination of Danthonia caespitosa, Atriplex nummularia and A. vesicaria are reported. The rate and total germination of all three dryland species from New South Wales decreased as water potential declined. Germination rates increased with increasing temperature, but final germinations were greatest at intermediate temperatures (20 - 25 C). Low water potentials during optimum temperatures produced the best germination. Osmotic and matric potential effects were qualitatively similar, but osmotic inhibition decreased at low temperatures. Both Atriplex germinated at extreme temperatures (5 and 40 C), while D. caespitosa failed to germinate. At low water potential (-15 bars) A. nummularia germinated from 15 to 40 C and D. caespitosa at 25C, while A. vesicaria germinated poorly at all temperatures. A. nummularia had the greatest resistance to environmental stress. Atriplex spp may germinate after rains during summer as well as winter; Danthonia germination is likely only during spring and autumn. (Jahns-Arizona)
W76-10185

MOISTURE USE EFFICIENCY OF DRYLAND CROPS AS INFLUENCED BY FERTILIZER USE II. RABI CEREALS,
Indian Agricultural Research Inst. New Delhi.
For primary bibliographic entry see Field 3F.
W76-10186

ACCUMULATION AND MOBILITY OF CESIUM IN ROOTS OF TULIP POPLAR SEEDLINGS,
Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries, and Wildlife Development.
For primary bibliographic entry see Field 5B.
W76-10297

RADIOCESIUM LEVELS IN VEGETATION COLONIZING A CONTAMINATED FLOOD PLAIN,
Savannah River Ecology Lab., Aiken, S.C.
For primary bibliographic entry see Field 5C.
W76-10298

SEASONAL VARIATION IN RADIOCESIUM CONCENTRATIONS IN THREE TREE SPECIES,
Savannah River Ecology Lab., Aiken, S.C.
For primary bibliographic entry see Field 5C.
W76-10299

EFFECTS OF TREE SPECIES, TEMPERATURE, AND SOIL ON TRANSFER OF MANGANESE-54 FROM LITTER TO ROOTS IN A MICROCOSM,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W76-10317

INFLUENCE OF NUTRIENT AVAILABILITY ON ECOSYSTEM STRUCTURE,
Mansfield State College, Pa. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W76-10324

NUTRIENT RETURN IN THE STEMFLOW AND THROUGHFALL OF INDIVIDUAL TREES IN THE PIEDMONT DECIDUOUS FOREST,
Duke Univ., Durham, N. C. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W76-10326

2J. Erosion and Sedimentation

SEASONAL DYNAMICS OF SUSPENDED MATTER IN THE AZOV SEA, (IN RUSSIAN),
Rostov-on-Don State Univ. (USSR).
Yu. P. Khrustalev, L. Z. Ganicheva, and L. A. Chernousova.
Izv Sev-Kavk Nauchn Tsentra Yvssh Shk Estestv Nauki. 1, p 76-80, 1974.

Descriptors: Suspended solids, Seasonal, Productivity, Rivers.
Identifiers: Biological studies, *USSR(Azov Sea).

On the basis of seasonal observations the main sources of suspended material in the Azov Sea (due to shore abrasion, disintegration of bottom rocks and discharge of the Don and Kuban Rivers) were determined and their seasonal dynamics traced. A pattern of quantitative distribution and dependence on hydrologic conditions, biological productivity and intensity of shore abrasion, and evacuation of materials by the Don and Kuban Rivers was established.--Copyright 1975, Biological Abstracts, Inc.
W76-10126

THE SIMULATION OF SEDIMENT TRANSPORT,
Hydrocomp, Inc., Palo Alto, Calif.
K. M. Leytham.
Simulation Network Newsletter, (Hydrocomp), Vol. 7, No. 8, p 1-8, November 15, 1975. 4 fig, 9 ref.

Descriptors: *Analytical techniques, *Simulation analysis, *Clays, *Sands, *Silts, Sediments, Mathmatical models, Model studies, Runoff, Natural streams, Scour, *Sediment transport.

A deterministic, fixed bed stream sediment transport model has been developed which accepts inputs of water and sediment from the land surface hhase as modeled by the Agricultural Runoff Management (ARM) Model. A kinematic wave technique is used to simulate flows in the system. Interchange of suspended material with stream bed material, scour and aggradation, the effect of armoring on scour rates, and longitudinal dispersion due to variations in velocity are the major sediment processes represented. Sediment outflow from a channel reach is first approximated by assuming slug flow but the estimate is later adjusted to allow for longitudinal dispersion and changes in sediment concentration with time. It is assumed that all the sand, some silt, and a small portion of the clay settle out during the modeling interval. Steady state transport rates for cohesionless materials are converted to scour rates by assuming that ultimate steady state concentrations would be achieved by the end of each modeling interval. The model includes additional algorithms for beds containing cohesive clay and silt materials. Armoring, an effect in which immobile, cohesionless particles protect the particles under them from scour, is included in the model. The algorithms for settling and scour are used to calculate a new concentration which, together with the initial concentration assumed for slug flow, is used to calculate the sediment outflow. (Snyder-FIRL)
W76-10244

NUTRIENT LOSSES IN PARTICULATE FORM AS WEIR POND SEDIMENTS FROM FOUR UNIT WATERSHEDS IN THE SOUTHERN APPALACHIANS,
Georgia Univ., Athens. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W76-10330

SYMPOSIUM ON MODELING TECHNIQUES, VOLUME II.
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 8B.
W76-10415

TESTS ON THE EQUILIBRIUM PROBILES OF MODEL BEACHES AND THE EFFECTS OF GRAIN SHAPE AND SIZE DISTRIBUTION,
Tetra Tech, Inc., Pasadena, Calif.
For primary bibliographic entry see Field 2L.
W76-10422

TIME GROWTH OF TIDAL DUNES IN A PHYSICAL MODEL,
Queen's Univ., Kingston, Ontario. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10424

LABORATORY EFFECTS IN COASTAL MOVABLE-BED MODELS,
Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2L.
W76-10425

SIMULATION OF DELTA BUILDING PROCESS,
Central Water and Power Research Station, Poona (India).
For primary bibliographic entry see Field 2L.
W76-10426

MOVABLE-BED MODEL INVESTIGATION OF TAICHUNG HARBOR, TAIWAN, REP. OF CHINA,
Florida Univ., Gainesville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10427

COASTAL MOBILE BED MODEL - DOES IT WORK,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10428

MODELING SEDIMENT DEPOSITION IN A TIDAL RIVER,
Dames and Moore, Cranford, N.J.
For primary bibliographic entry see Field 2L.
W76-10447

COMPUTER SIMULATION OF BEACH EROSION AND PROFILE MODIFICATION DUE TO WAVES,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10448

MODELLING OF SUSPENSION CURRENTS,
Trondheim Univ. (Norway). Vassdrags-og Havnelaboratoriet.
For primary bibliographic entry see Field 5B.
W76-10449

ANALYTICAL MODEL OF DUCT-FLOW FLUIDIZATION,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 8B.
W76-10450

LCHF COASTAL SEDIMENT MODELING TECHNIQUES,
Laboratoire Central d'Hydraulique de France, Paris.
For primary bibliographic entry see Field 2L.
W76-10463

2K. Chemical Processes

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMEO, COLORADO TO CISCO, UTAH: PART 1. DATA SUMMARY,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 7C.
W76-10142

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMEO, COLORADO, TO CISCO, UTAH: PART 2. BASIC DATA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 7C.
W76-10143

MAPS SHOWING GROUND-WATER CONDITIONS IN THE RANEGRAS PLAIN AND BUTLER VALLEY AREAS, YUMA COUNTY, ARIZONA--1975,
Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 7C.
W76-10149

BORON AND ARSENIC STUDIES IN FLORIDA WATERS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5B.
W76-10265

INTERLABORATORY QUALITY CONTROL STUDY NO. 5, CHROMIUM, IRON, MOLYBDENUM AND VANADIUM,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W76-10493

INTERLABORATORY QUALITY CONTROL STUDY NO. 4, ARSENIC, CADMIUM, COBALT, MERCURY AND NICKEL,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W76-10495

2L. Estuaries

SHORT-TERM REGULATION OF BOD UPSETS IN AN ESTUARY,
Delaware Univ., Newark, Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5G.
W76-10020

INDUSTRIAL RESEARCH INSTITUTE STUDYING POLLUTION PROBLEMS OF SETO INLAND SEA,
Chugoku National Industrial Research Inst., Hiroshima (Japan).
For primary bibliographic entry see Field 5B.
W76-10031

ECOSYSTEMS ANALYSIS OF THE BIG CYPRESS SWAMP AND ESTUATIES,
Environmental Protection Agency, Athens, Ga. Surveillance and analysis Div.
For primary bibliographic entry see Field 6G.
W76-10046

AN ANALYSIS OF THE DYNAMICS OF DDT AND ITS DERIVATIVES, DDD AND DDE, IN MARINE SEDIMENTS
Stanford Univ., Pacific Grove, Calif. Hopkins Marine Station.
For primary bibliographic entry see Field 5C.
W76-10050

TUBE-WORM-SEDIMENT RELATIONSHIPS IN POPULATIONS OF PECTINARIA GOULDII (POLYCHAETA: PECTINARIIDAE) FROM BARNEGAT BAY, NEW JERSEY,
Rutgers-The State Univ., New Brunswick, N. J. Dept. of Zoology.
D. A. Busch, and R. E. Loveland.
Marine Biology, Vol. 33, No. 3, p. 255-264, 1975. 1 tab., 11 fig., 13 ref.

Descriptors: Environmental effects, Animal behavior, Sediments, Sands, *Bottom sediments, Particle size, *Worms, Benthos, *Sludge worms, Sampling, Aquatic animals, Benthic fauna, Methodology, Growth stages, New Jersey, Bays, Distribution.
Identifiers: *Pectinaria sp., *Polychaetes, *Tube worms, *Barnegat Bay(NJ).

Pectinaria gouldii constructs over its lifetime a conical tube of increasingly large sand grains, regardless of surrounding sediment characteristics. However, the rate of increase of mean grain size of the tube and the population density of the worm vary with sediment type. The distribution of this species is limited by sediment composition. Worms of equal length will always have equal anterior tube apertures, although the thickness of the tube walls may be unequal. Tube surface-area, worm dry weight, and tube weight all increase as a power function of the tube length. The conical shape and increasing mass of the tube impose an upper limit to worm growth, but do not interfere with worm mobility. (Katz)
W76-10061

A COMPARISON OF GROWTH AND ABUNDANCE FOR TIDAL POOL FISHES IN CALIFORNIA AND BRITISH COLUMBIA,
Guelph Univ. (Ontario). Dept. of Zoology.
E. M. P. Chadwick.
Journal of Fish Biology, Vol. 8, No. 1, p. 27-34, 1976. 5 fig., 3 tab., 20 ref.

Descriptors: Intertidal areas, Population, Analytical techniques, *Growth rates, *California, *Sculpins, *Tidal waters, *Biological communities, *Fish populations, Statistical models, Fish, Habitats, Sampling, Microscopy, Life cycles, Life History Studies, Size.
Identifiers: *Oligocottus sp., Diversity index, *British Columbia, Age determination.

A qualitative comparison of species compositions, relative abundances, diversity and growth was made betwen tidal pool fishes collected in Port Renfrew, British Columbia and Bruels Point, California. The two most preponderant cottid species Oligocottus maculosus and Clinocottus globiceps were aged using vertebrae, from which back calculated growth values were obtained. Species from Port Renfrew were found to have a higher diversity index, greater species composition and abundance. No growth differences were found between the two localities despite the 1120 km (700 miles) separating them. (Katz)
W76-10064

PETROLEUM HYDROCARBONS: DEGRADATION AND GROWTH POTENTIAL FOR ATLANTIC OCEAN SEDIMENT BACTERIA,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W76-10068

PHYSICAL FACTORS CONTROLLING ABUNDANCE OF MEIOFAUNA ON TIDAL AND ATIDAL BEACHES,
Jordan Univ., Amman. Marine Science Programme.
For primary bibliographic entry see Field 5A.
W76-10069

FRESH WATER CAN BE STORED IN SALINE AQUIFERS,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 4B.
W76-10107

A COMPUTER SIMULATION OF COMPETITION AMONG FIVE SYMPATRIC CONGENERIC SPECIES OF XANTHID CRABS,
Puerto Rico Univ., Rio Piedras. Dept. of Biology.
E. M. Preston.
Ecology. 54(3), p 469-483, 1973.

Descriptors: *Crabs, *Simulation analysis, Computer models, *Hawaii, Competition.
Identifiers: Pocillopora-meandrina-var-nobilis, Trapezia-digitalis, Trapezia-ferruginea, Trapezia-flavomaculata, Trapezia-intermedia, Trapezia-wardi, Xanthid crabs.

In Hawaii 5 species of xanthid crabs of the genus Trapezia (T. intermedia, T. wardi, T. ferruginea, T. digitalis, T. flavomaculata) are commensals of the branching coral Pocillopora meandrina var. nobilis. As adults, crabs are found in heterosexual pairs. Intraspecific agonistic interactions typically restrict host occupancy to one pair per species, but multiple species combinations are common. Though niche overlap among the species is nearly complete, they exhibit statistically different host size requirements. Field observations suggested that the distribution patterns of the species are influenced by interference competition during host selection. A stochastic computer model of host selection produced species distributions similar to those observed in the field. In the absence of evidence consistent with alternative hypotheses, this suggests that interference competition resulting from random encounters during host selection by adults is sufficient to account for site variability in the distribution patterns of species of Trapezia. Simulation experiments were conducted to assess the relative importance of the potential sources of competitive pressure to each species of Trapezia. The suitability of the hosts available at each study site to each species was estimated (1) assuming the presence of competitors and (2) assuming the hosts were uncolonized. The decrease in suitability of the hosts due to the presence of competitors was used as an index of competitive pressure on the species. There was no significant correlation between the degree of niche overlap and the intensity of competition between species. Caution is advised in using niche overlap measurements to estimate competition intensity.--Copyright 1973, Biological Abstracts, Inc.
W76-10124

SEASONAL DYNAMICS OF SUSPENDED MATTER IN THE AZOV SEA, (IN RUSSIAN),
Rostov-on-Don State Univ. (USSR).
For primary bibliographic entry see Field 2J.
W76-10126

LARGE-SCALE ESTUARINE WATER QUALITY MATRIX MODEL,
Texas Univ. at Austin. Dept. of Electrical Engineering.
For primary bibliographic entry see Field 5B.
W76-10191

DISPOSAL OF SEWAGE FROM COASTAL TOWNS: THE CASE FOR SEA OUTFALLS,
Taylor (John) and Sons, London (England).
For primary bibliographic entry see Field 5E.
W76-10224

THE SIMULATION OF SEDIMENT TRANSPORT,
Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 2J.
W76-10244

THE ROLE OF PHYSICAL MODELING IN MARSH-ESTUARINE MINERAL-CYCLING RESEARCH,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab.
For primary bibliographic entry see Field 5B.
W76-10276

SYSTEMS MODELS FOR PHOSPHORUS MANAGEMENT IN FLORIDA,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5C.
W76-10277

MINERAL CYCLING IN MARINE ECOSYSTEMS,
Georgia Univ., Athens. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W76-10278

DISTRIBUTION OF COPPER AND ZINC IN OYSTERS AND SEDIMENTS FROM THREE COASTAL-PLAIN ESTUARIES,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5C.
W76-10279

EFFECTS OF ENVIRONMENTAL LEVELS OF MERCURY AND CADMIUM ON RATES OF METAL UPTAKE AND GROWTH PHYSIOLOGY OF SELECTED GENERA OF MARINE PHYTOPLANKTON,
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5C.
W76-10280

THE ROLE OF SPARTINA ALTERNIFLORA IN THE FLOW OF LEAD, CADMIUM, AND COPPER THROUGH THE SALT-MARSH ECOSYSTEM,
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5C.
W76-10281

HEAVY-METAL CONCENTRATIONS IN SELECTED GEORGIA ESTUARINE ORGANISMS WITH COMPARATIVE FOOD-HABIT DATA,
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5C.
W76-10282

CONCENTRATIONS OF TOTAL MERCURY AND METHYL MERCURY IN FISH AND OTHER COASTAL ORGANISMS: IMPLICATIONS TO MERCURY CYCLING,
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5B.
W76-10283

NITROGEN REGENERATION BY THE CTENOPHORE MNEMIOPSIS LEIDYI,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 5C.
W76-10284

THE ROLE OF BENTHIC COMMUNITIES IN THE NITROGEN AND PHOSPHORUS CYCLES OF AN ESTUARY,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 5C.
W76-10285

RIVER INPUT OF INORGANIC PHOSPHORUS AND NITROGEN TO THE SOUTHEASTERN SALT-MARSH ESTUARINE ENVIRONMENT,
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5C.
W76-10286

BASE-LINE DATA ON EVERGLADES SOIL-PLANT SYSTEMS: ELEMENTAL COMPOSITION, BIOMASS, AND SOIL DEPTH,
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
For primary bibliographic entry see Field 5C.
W76-10314

AROCLOR 1016: TOXICITY TO AND UPTAKE BY ESTUARINE ANIMALS,
Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W76-10340

DEEP-SEA BACTERIA: GROWTH AND UTILIZATION OF HYDROCARBONS AT AMBIENT AND IN SITU PRESSURE,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W76-10349

A DISCUSSION OF THE EFFECTS OF CERTAIN POTENTIAL TOXICANTS ON FISH AND SHELLFISH IN THE UPPER DELAWARE ESTUARY,
Delaware Univ., Newark.
For primary bibliographic entry see Field 5C.
W76-10352

PROCEEDINGS OF THE CONFERENCE ON MARINE BIOLOGY IN ENVIRONMENTAL PROTECTION HELD AT SAN CLEMENTE ISLAND, CALIFORNIA ON 13-15 NOVEMBER, 1973.
Naval Undersea Center, San Diego, Calif.
For primary bibliographic entry see Field 5C.
W76-10353

PROBLEMS AND TECHNIQUES OF MARINE BIOLOGY IN THE FIELD: MODELING THE MARINE ECOSYSTEM,
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W76-10355

ISOLATION OF THE RUNOFF-DEPENDENT SALINITY IN A SHALLOW RIVER-MOUTH OFFSHORE ZONE UNDER CONDITIONS OF WIND-INDUCED RISE AND FALL OF THE WATER LEVEL, (IN RUSSIAN),
Azovskii Nauchno-Issledovatelskii Institut Rybnogo Khozyaistva, Rostov-na Donu (USSR).
A. M. Bronfman.
Izv Sev-Kavk Nauchn Tsentra Vyssh Shk Estestv Nauki, p 82-84, 1974.

Descriptors: *Salinity, *Rivers, Water levels, Benthos, Isolation, Fish, Spawning, Bays, Plankton, Shallow water, Methodology, Spatial distribution.
Identifiers: *USSR(Don Rivermouth).

A method is proposed for isolating the runoff-dependent component of salinity in the shallow offshore zone of the Don River (USSR), free of the effect of wind-induced fluctuations of the water level. The runoff-dependent salinity can differ from the actual (measured) salinity at a given point of the offshore zone by more than 3.0%. The route of Don River waters in Taganrog bay (Azov Sea) is defined, explaining the specific characteristics of the spatial distribution of a number of hydrochemical indices and of some biological characteristics (plankton benthos, fry of fish spawning in the Don, etc.).--Copyright 1975, Biological Abstracts, Inc.
W76-10361

MARINE POLLUTION MONITORING (PETROLEUM). PROCEEDINGS OF A SYMPOSIUM AND WORKSHOP,
National Oceanographic and Atmospheric Administration, Rockville, Md.
For primary bibliographic entry see Field 5B.
W76-10370

MOVEMENT OF SPILLED OIL IN SAN FRANCISCO BAY AS PREDICTED BY ESTUARINE NONTIDAL DRIFT,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 5B.
W76-10385

OIL POLLUTION ALONG THE INDIAN COASTLINE,
National Inst. of Oceanography, Panjim (India).
For primary bibliographic entry see Field 5B.
W76-10386

SAMPLING ERRORS IN THE QUANTIFICATION OF PETROLEUM IN BOSTON HARBOR WATER,
Massachusetts Inst. of Technology, Cambridge. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5A.
W76-10387

LONG TERM WEATHERING CHARACTERISTICS OF IRANIAN CRUDE OIL: THE WRECK OF THE 'NORTHERN GULF',
Bowdoin Coll., Brunswick, Maine. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W76-10405

DETERMINATION OF HYDROCARBONS IN MARINE ORGANISMS AND SEDIMENTS BY THIN LAYER CHROMATOGRAPHY,
California Univ., Berkeley. Naval Biomedical Research Lab.
For primary bibliographic entry see Field 5A.
W76-10407

SYMPOSIUM ON MODELING TECHNIQUES, VOLUME II.
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 8B.
W76-10415

RESONANCES IN HARBORS WITH VARIABLE DEPTHS,
Florida Atlantic Univ., Boca Raton. Dept. of Ocean Engineering.
For primary bibliographic entry see Field 8B.
W76-10416

WAVE RESPONSE OF OFFSHORE BOTTOMLESS HARBORS,
Tehran Univ. (Iran).
For primary bibliographic entry see Field 8B.
W76-10417

NONLINEAR LATERAL OSCILLATION IN A HARBOUR MODEL,
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
For primary bibliographic entry see Field 8B.
W76-10418

NUMERICAL PREDICTION OF HARBOR RESPONSES,
Hawaii Univ., Honolulu. Dept. of Ocean Engineering.
For primary bibliographic entry see Field 8B.
W76-10419

FREE OSCILLATIONS IN BAYS AND HARBORS,
Department of the Environment, Ottawa (Ontario). Oceanography Branch.
For primary bibliographic entry see Field 8B.
W76-10420

COMPUTATIONS OF HARBOR OSCILLATIONS BY RAY METHODS,
Technical Univ., of Denmark, Lyngby. Lab., of Applied Mathematical Physics.
For primary bibliographic entry see Field 8B.
W76-10421

TESTS ON THE EQUILIBRIUM PROBILES OF MODEL BEACHES AND THE EFFECTS OF GRAIN SHAPE AND SIZE DISTRIBUTION,
Tetra Tech, Inc., Pasadena, Calif.
J. I. Collins, and C. B. Chesnutt.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 907-926, 1975. 13 fig, 3 tab, 25 ref. Army DACW72-72-C-0024.

Descriptors: *Beaches, *Model studies, *Hydraulic models, Sediment transport, Sediments, Sands, Erosion, Beach erosion, Sedimentation, Deposition(Sediments), Geomorphology, Waves(Water), Ocean waves, Particle size.
Identifiers: *Movable-bed models.

This study was conducted to investigate the effects of the model sediment size distribution and particle shape in movable-bed models. Secondly, an experimental evaluation of the scale model relationship was performed. The results showed that the effects of grain shape and size distribution are varied. For many cases there was little or no measurable effect, but in others, particularly for smaller wave steepnesses, marked differences were apparent. These included the appearance of multiple bars in the case of bimodal sediment size distribution and an instable bar in the cases of very narrow unimodal size distributions and for some cases with a spherical grain shape. It was found that the initial profile slope can influence the final stable profile shape. 'Rocklite', a manufactured, light-weight ceramic sediment, appeared to be a potentially useful model material. The attempted verification tests were only partially successful. The slope of the foreshore was reproduced in scale, but the shape of the offshore and surf zones and the movement of the shoreline were not reproduced. (See also W76-10415) (Sims-ISWS)
W76-10422

PHYSICAL MODELING OF SCOUR INITIATION AND SEDIMENT TRANSPORT IN DISTORTED TIDAL MODELS,
Florida Univ., Gainesville. Dept. of Civil Engineering.
B. A. Christensen, and R. M. Snyder.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 927-935, 1975. 1 fig, 8 ref. NOAA 04-5-158-44.

Descriptors: *Scour, *Sediment transport, *Model studies, *Hydraulic models, Particle size, Roughness(Hydraulic), Estuaries, Inland waterways, Erosion, Sedimentation, Hydraulics.
Identifiers: *Movable-bed models.

While the construction and operation of undistorted fixed bed Froude models of hydraulic structures (such as spillways, intakes, guide vanes, etc.) generally do not present substantial problems, this is not the case when models of entire waterways, estuarine regions, and coastal

areas are considered. The horizontal extension of such flow systems combined with the need for not too small depths in the model require the operation of distorted models with artificial roughness elements introduced to distort the slope of the energy grade line correctly. Formulas for the size and distribution of these roughness elements were developed and tested in a tidal model of the canal between Little Lake Worth and Lake Worth in Palm Beach County, Florida. Furthermore grain-size model scales which will allow true modeling of scour initiation and sediment transport were developed for lighter than prototype model bed materials, thereby avoiding too small model grain-size. (See also W76-10415) (Sims-ISWS)
W76-10423

TIME GROWTH OF TIDAL DUNES IN A PHYSICAL MODEL,
Queen's Univ., Kingston, Ontario. Dept. of Civil Engineering.
M. S. Yalin, and W. A. Price.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 936-944, 1975. 2 fig, 6 ref.

Descriptors: *Sediment transport, *Dunes, *Model studies, Mathematical models, Hydraulic models, Tidal effects, Particle size, Ripple marks, Sand waves, Sands, Erosion, Sedimentation, Tides, Estuaries.

A method was suggested to determine the scale of the duration of the development of dunes forming on the bed of a tranquil flow. It was expected that the scale relations determined should be applicable to both unidirectional and tidal flows. The derivation rested on dimensional principles as well as on a mathematical relation describing the duration of development as a certain function of the geometric dimensions of dunes in their developed state, and a typical transport rate. The treatment was two-dimensional, the granular material being cohesionless. It was assumed that the movable bed of the model is formed by either sand or a lightweight material. The application of the method was illustrated by a numerical example. (See also W76-10415) (Sims-ISWS)
W76-10424

LABORATORY EFFECTS IN COASTAL MOVABLE-BED MODELS,
Coastal Engineering Research Center, Fort Belvoir, Va.
C. B. Chesnutt.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 945-961, 1975. 9 fig, 1 tab, 8 ref.

Descriptors: *Beaches, *Sediment transport, *Model studies, *Hydraulic models, Sands, Sediments, Coasts, Shores, Estuaries, Waves(Water), Ocean waves, Erosion, Sedimentation.
Identifiers: *Movable-bed models.

Profile changes were measured during three lengthy experiments in a 6-ft wide by 3-ft deep by 107-ft long outdoor wave tank, with a piston wave generator at one end and a movable bed of 0.2-mm sand at the other end. Generator period (1.90 sec), water depth (2.33 ft), and nominal wave height (0.36 ft) were constant in the three experimnts. The controlled experimental variables were the initial test length (distance from the wave generator to the initial still water level intercept) and the initial profile slope. The water temperature was uncontrolled. The average shoreline recession rate (which governed the rate of profile development) varied from 0.02 to 0.10 ft/hr during the first 50 hours of the three experiments. The differences in recession rate were apparently the result of water temperature variations and/or the differences in initial test length. Trasiet and final profile shapes appeared to be affected by the initial profile slope. (See also W76-10415) (Sims-ISWS)
W76-10425

SIMULATION OF DELTA BUILDING PROCESS,
Central Water and Power Research Station, Poona (India).
S. V. Chitale, V. G. Galgali, and K. N. Appukuttan.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 962-973, 1975. 4 fig, 1 tab. 3 ref.

Descriptors: *Deltas, *Sedimentation, *Model studies, *Hydraulic models, Rivers, Dams, Reservoirs, Sediments, Suspended solids, Sedimentation rates, Deposition(Sediments), Reservoir silting, Silting, Sedimentology.
Identifiers: *India, *Movable-bed models, *Beas River(India), *Pandoh Dam(India).

A rockfill dam of height 200 feet above the river bed is under construction on Beas river at Pandoh for diverting waters to the Bhakra reservoir on river Sutlej through a long water conductor system. The Beas river has a steep slope of about 1 in 200. After construction of the dam it is expected that the river would ultimately get completely silted up to the crest of the spillway. Model investigations were carried out to attempt scaler reproduction of the formation of sediment delta and of the conditions obtaining after final silting of the reservoir which were considered critical for sediment entry into the intake for diversion of the Beas supplies into the Sutlej. At the end of 10th cycle, the sediment inflow and the outflow equilized, indicating the stability of the delta. It was also observed that the slope of the stabilized delta was more or less same as the original bed slope of the river allowing for changes in the cross sectional flow area at higher elevations. (See also W76-10415) (Sims - ISWS)
W76-10426

MOVABLE-BED MODEL INVESTIGATION OF TAICHUNG HARBOR, TAIWAN, REP. OF CHINA,
Florida Univ., Gainesville. Dept. of Civil Engineering.
H-S. Hou, B. A. Christensen, and T. Y. Chiu.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, Calfornia, September 3-5, 1975. American Society of Civil Engineers, New York, p 974-992, 1975. 21 fig, 3 tab, 1 ref.

Descriptors: *Harbors, *Littoral drift, *Model studies, Hydraulic models, Sediment transport, Ocean waves, Waves(Water), Sedimentation, Silting, Coasts, Beaches, Sands.
Identifiers: *Movable-bed models, *Taiwan, *Taichung Harbor(Taiwan).

The paper describes the establishment and operation of a distorted movable-bed model of Taichung Harbor located on the west coast of Taiwan where sand migration from the littoral drift, partially nourished by the Ta-Chia River, makes extensive dredging necessary to keep the harbor inlet channel open. The model employed is a three-dimensional movable-bed Froude model for all prototype depths less than 50 m. At depths in excess of this value the influence of sediment transport is considered negligible and a fixed-bed is used. The objective of the model study was to investigate the performance of various outer breakwater configurations and to select the optimum configuration which will stabilize the harbor inlet channel, i.e., protect it from excessive shoaling caused by the seasonal wave action and the littoral drift. The wave used in the model corresponds to a wave of 5 m in height and 12 seconds in period from a northerly direction. The optimum breakwater configuration was determined such that dredging of the harbor inlet will not be necessary during the first 15 years of the structures lifetime. After this period of time has elapsed minor yearly dredgings are expected to be needed. (See also W76-10415) (Sims - ISWS)
W76-10427

COASTAL MOBILE BED MODEL - DOES IT WORK,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
J. W. Kamphuis.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 993-1009, 1975. 2 fig, 1 tab, 27 ref, 2 append.

Descriptors: *Coasts, *Beaches, *Model studies, *Hydraulic models, Sands, Littoral drift, Erosion, Sedimentation, Sediment transport, Particle size, Geomorphology, Tracers, Coastal engineering.
Identifiers: *Movable-bed models.

After a number of years of study, coastal mobile bed models were classified and scale effects resulting from various non-similarities were discussed. Two methods of classification were given - one according to non-similarity of basic scaling relationships and another according to the type of model required. All but one class of model is subject to substantial scale effect and thus no easy scaling recipes can be given. Modelling still remains an art and this extensive study only results in pointing out some common pitfalls to be avoided. Models using lightweight material were shown to be eminently unsuitable for inshore areas and it appears to be virtually impossible to determine time scales for bed morphology because of scale effect. The simple tracer model appears to yield best value for money invested. (See also W76-10415) (Sims -ISWS)
W76-10428

MULTILAYER HYDRODYNAMICAL-NUMERICAL MODELS,
Naval Environmental Prediction Research Facility, Monterey, Calif.
T. Laevastu.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1010-1025, 1975. 6 fig.

Descriptors: *Coasts, *Hydrodynamics, *Model studies, Coastal engineering, Tides, Winds, Currents(Water), Ocean currents, Mathematical models, Computer models, Path of pollutants, Waves(Water), Estuaries, Beaches, Erosion, Deposition(Sediments), Sedimentation.

The basic hydrodynamical formulas were solved with an explicit finite difference method of Hansen. The layers (up to five layers in the existing model) are vertically integrated. The upper layer is driven by tides, winds, and thermohaline gradients. The lower layers are coupled with internal friction, as well as with horizontal and vertical density gradients. The model uses a staggered grid (Hansen type), actual depths, and coastline. The tides and 'permanent thermohaline currents' were introduced at the selected open boundaries. The surface wind was specified at each time step.

Verification and tuning of the model was done with tide gage data or curtent recordings in one or more locations within the area which have not been used for open boundary input. The basic outputs of the model at desired time intervals are: sea level, actual depth, and currents. Various other subroutines have been added to the models, which give: transport and diffusion of pollutants, drift of objects, and transport of water through various sections (flushing). Some examples and verifications were shown together with some specific applications of the results to coastal engineering and water management problems. (See also W76-10415) (Sims - ISWS)
W76-10429

MULTI-PHASED MODEL STUDY OF THE SETO INLAND SEA,
Chugoku Inst., of Industrial Technology, Kure (Japan). Hydraulic Research Section II.
N. Hayakawa, T. Higo, H. Tanabe, Y. Takasugi, and M. Takarada.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1026-1041, 1975. 6 fig, 2 tab, 2 ref.

Descriptors: *Model studies, *Bays, *Estuaries, Mathematical models, Hydraulic models, Tides, Sea level, Circulation, Water circulation, Water pollution, Currents(Water), Flow, Tidal waters.
Identifiers: *Seto Inland Sea(Japan), *Japan.

The Seto Inland Sea of Japan, with an area of about 21,400 sq km and greatly complicated topography, is plagued by water pollution problems due to heavy concentration of population and industry in the surrounding area. Reported here was an endeavor to develop both hydraulic and mathematical models of an enormous size with the ultimate goal of predicting water pollution in the Sea. Much effort was spent to counter the size and complex geometry of the model. Results of the verification study and some associated problems were described. (See also W76-10415) (Sims - ISWS)
W76-10430

TIDAL RESIDUAL CIRCULATIONS IN THE HYDRAULIC MODEL,
Ehime Univ., Matsuyama (Japan). Dept. of Ocean Engineering.
H. Higuchi, T. Sugimoto, H. Ueshima, T. Yanagi, and H. Yasuda.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1042-1049, 1975. 9 fig, 3 ref.

Descriptors: *Model studies, *Bays, *Estuaries, Hydraulic models, Tides, Sea level, Circulation, Water circulation, Water pollution, Currents(Water), Flow, Tidal waters, Coasts.
Identifiers: *Hinchi-Nada Sea(Japan), *Seto Inland Sea(Japan), *Japan.

The tidal residual circulation induced by the coastal boundary geometry of the bay is studied mainly by use of a hydraulic model experiment. The theoretical suggestion that these circulations are formed by the rotation of the non-linear effect of the tidal currents was verified, and the process was made more clear. These circulations have great importance for local distributions of substances as well as water exchange of the bay. They are similarly reproduced in the model when the non-dimensional parameters, Froude number and Reynolds numbers, are made to coincide between the model and the prototype. (See also W76-10415) (Sims-ISWS)
W76-10431

MODELING OF TURBULENCE IN THE SURF ZONE,
Technische Hogeschool, Delft(Netherlands). Dept. of Civil Engineering.
J. A. Battjes.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1050-1061, 1975. 16 ref.

Descriptors: *Surf, *Ocean waves, *Turbulence, *Model studies, Mathematical models, Coasts, Shores, Beaches, Energy dissipation, Energy loss, Waves(Water).

The problem dealt with was the estimation of the horizontal turbulent momentum exchange in the surf zone. In contrast to previous models, the relevant properties were estimated taking account of the wave energy dissipation by breaking. The resultant expression for the turbulent energy dissipation, combined with an analysis of the interaction of the turbulent velocity field with the rate of strain in the longshore current, led to estimates of the turbulence intensity, its macro-length-scale, and its contribution to the momentum exchange. The latter appeared in a form similar to that in the common eddy-viscosity models, although this had not been assumed a priori. The coefficients in the resultant expression, while of necessity adjustable, are expected to be of order unity. (See also W76-10415) (Sims-ISWS)
W76-10432

NEARSHORE WATER CIRCULATION INDUCED BY WIND AND WAVES,
Delaware Univ., Newark. Dept. of Civil Engineering.
W. A. Birkemeier, and R. A. Dalrymple.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1062-1081, 1975. 12 fig, 13 ref. ONR N00014-69-A-0407.

Descriptors: *Waves(Water), *Winds, *Beaches, *Model studies, Mathematical models, Coasts, Shores, Wind tides, Ocean waves, Surf, Seiches, Circulation, Water circulation, Harbors, Estuaries.

A finite difference model for time-dependent, wave-induced nearshore circulation has been developed which includes wave refraction, wave-current interaction, wave setup, wind effects, and coastal flooding. Results were shown for set-up in wave tanks due to steady waves and wave groups, and also for a longshore periodic beach. Important results were that tuned wave groups can incite seiching in enclosed basins and harbors and that rip currents will be induced or maintained by the presence of surf zone channels. (See also W76-10415) (Sims-ISWS)
W76-10433

NUMERICAL MODEL FOR WAVE REFRACTION BY FINITE AMPLITUDE WAVE THEORIES,
California State Univ., Long Beach. Dept. of Civil Engineering.
H-L. Chu.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1082-1100, 1975. 6 fig, 11 ref, 2 append.

Descriptors: *Model studies, *Waves(Water), *Refraction(Water waves), Mathematical models, Computer models, Ocean waves, Equations.
Identifiers: Wave rays, Small amplitude waves, Stokes' third order waves, Cnoidal waves.

A mathematical model applying the concept of finite amplitude surface waves for computing and plotting wave refraction diagrams was presented. The important wave parameters considered in the model were wave height, wave period, and bottom contours. For the construction of the model, equations governing the wave ray curvature for a depth gradient of unit (defined as the curvature coefficient) were derived separately for the small amplitude waves, the Stokes' third order waves, and the cnoidal waves. The equations were also presented graphically, showing the regions of applicability for each theory and regions' overlap. Application of the model was demonstrated on a symmetrical shape submarine valley using a set of 12-second period waves with initial wave heights of 0 feet, 5 feet and 10 feet, respectively. Results in the form of wave refraction diagrams from the finite amplitude model were presented and were compared with those obtained from the small amplitude model. As the initial wave height to depth ratio H/d increased, refraction of wave rays subsided, which indicated that the small amplitude wave refraction model tended to overestimate the refraction. Even for waves of relatively small initial H/d ratio the differences in refraction patterns between the results from the small amplitude and those from the finite amplitude models were significant. (See also W76-10415) (Sims-ISWS)
W76-10434

SCALE EFFECTS ON PHYSICAL/MATHEMATICAL MODELING,
Hawaii Univ., Honolulu. Dept. of Ocean Engineering.
For primary bibliographic entry see Field 8B.
W76-10435

APPLICATION OF A DYNAMIC NETWORK MODEL TO HYDRAULIC AND WATER QUALITY STUDIES OF THE ST. LAWRENCE RIVER,
For primary bibliographic entry see Field 5B.
W76-10440

MEASURED CONTRIBUTIONS OF THE TERMS OF THE VERTICALLY INTEGRATED HYDRODYNAMIC EQUATIONS,
Delta Service, Rijkswaterstaat (Netherlands).
W. J. Van de Ree, and H. Y. Schaap.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1237-1248, 1975. 6 fig, 2 ref.

Descriptors: *Model studies, *Ocean currents, *Estuaries, *Tidal waters, On-site investigations, Measurement, Currents(Water), Current meters, Hydraulic models, Water levels, Tides, Flow, Data processing, Mathematical models.
Identifiers: *The Netherlands, *North Sea.

In engineering studies for the Delta project, two-dimensional tidal computations were used in conjunction with hydraulic models for the prediction of tide levels and currents in the estuaries of the Rhine and Scheldt and adjacent sections of the Southern North Sea. A detailed field survey of tide levels and currents near Goeree, which was made to assess changes in tide levels and currents as a result of the closure of one of the branches of the Rhine estuary, made it possible to compute the time histories of all terms of the momentum equation at a few locations. During the survey, simultaneous current measurements were made at 16 stations over a 13-hour period. The velocities and direction were measured in the vertical at several locations. From this data the vertically-averaged velocities and directions were computed. In addition, at a large number of stations the tide levels

were measured. Float measurements were made also. From the analysis of this data it was concluded that, in hydraulic models of areas with flow conditions similar to those investigated, and at the same latitude, the effect of the earth's rotation should be simulated. If two-dimensional tidal computations of such areas are made, the advection terms should not be neglected in the computation, as the contribution of these terms is significant in the determination of the flow field. (See also W76-10415) (Sims-ISWS)
W76-10442

SIMULATION OF THE SALINITY DISTRIBUTION IN THE ST. LAWRENCE ESTUARY BY A TWO-DIMENSIONAL MATHEMATICAL MODEL,
Laval Univ., Quebec. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W76-10443

OVERVIEW OF PHYSICAL ESTUARY PRACTICE,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
F. A. Herrmann, Jr.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1270-1290, 1975. 12 fig, 8 ref.

Descriptors: *Model studies, *Estuaries, *Hydraulic models, *Mathematical models, Reviews, Rivers, Sediment transport, Flow, Sea water, Freshwater, Salinity, Water quality.
Identifiers: Model scales, Scale effects, Model verification.

A very brief discussion is presented of similitude relations, selection of model scales, and scale effects for distorted-scale, fixed-bed physical models of estuaries. The problems susceptible to model analysis were enumerated. The advantages and disadvantages of employing physical models were discussed, including a cursory comparison with numerical models. The purpose and methods for model verification were discussed and verification test results were presented from several typical models. An emergency study in the Delaware River model to determine the rate of saltwater advancement up the estuary during the 1965 drought was described. A study of shoaling in Brunswick Harbor was also presented. The recommended improvement plan has been constructed in the field and data were presented for comparison with the model predictions. The cost savings effected by a dike rehabilitation study in the Delaware River model were also presented. (See also W76-10415) (Sims-ISWS)
W76-10444

COMPARISON BETWEEN PHYSICAL AND MATHEMATICAL MODELLING OF A TIDAL FJORD SYSTEM IN NORTHERN NORWAY,
Trondheim Univ. (Norway). Vassdrags- og Havnelaboratoriet.
T. Audunson, J. P. Mathisen, H. Naeser, and T. McClimans.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1291-1310, 1975. 13 fig, 1 tab, 10 ref.

Descriptors: *Model studies, *Fjords, *Tidal waters, Mathematical models, Hydraulic models, On-site investigations, Tides, Inlets(Waterways), Coasts, Currents(Water), Circulation, Water circulation, Diffusion, Tracers, Hydraulics, Hydrodynamics.
Identifiers: *Norway.

Results were presented from a physical and numerical model study of a tidal fjord system with three tidal inlets in northern Norway. The velocity field in the distorted physical model was shown to be in good agreement with available field data. The tidal velocity fields computed from a two-dimensional vertically integrated numerical model showed fair agreement with observations from the physical model. The computations showed little effect from the earth rotation. Stability of the numerical calculations required the incorporation of a diffusion term in the equations of motion. Numerical computations of spreading and dilution of tracer material employed a vertically integrated two-dimensional diffusion-advection model. In these computations use was made of the solution of the equations of motion. The numerical results were compared to similar results from the physical model. Agreement was found at some locations, disagreement at others. Diffusion effects in the distorted physical model seems larger than what was obtained in the numerical computations. The results strongly emphasized the importance of adequate data for comparison with numerical computations before such models may be used with confidence. (See also W76-10415) (Sims-ISWS)
W76-10445

COMPARISON OF HYDRAULIC AND NUMERICAL TIDAL MODELS,
Naval Postgraduate School, Monterey, Calif. Dept. of Oceanography.
E. B. Thornton, and L. S. Romer.
In: Symposium on Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1311-1328, 1975. 5 fig, 10 ref.

Descriptors: *Model studies, *Bays, *Tidal waters, Mathematical models, Hydraulic models, Tides, Tidal effects, Currents(Water), Circulation, Water circulation, Estuaries, Inlets(Waterways), Hydraulics, Hydrodynamics.
Identifiers: *San Diego Bay(Calif).

A comparison was made of the merits and limitations of hydraulic and numerical models. The discussion was limited to models having uniform density over depth and the driving force is the tide only. The model comparison was for San Diego Bay. Prototype measurements were used to calibrate both models. Comparable results were obtained from the hydraulic and numerical models dependent on how well they were calibrated. Techniques were described to divide large arrays representing embayments in the numerical model into smaller segments that are handled more easily and faster in the computer. This technique can allow using finer mesh lengths to obtain better spatial resolution. (See also W76-10415) (Sims-ISWS)
W76-10446

MODELING SEDIMENT DEPOSITION IN A TIDAL RIVER,
Dames and Moore, Cranford, N.J.
J. I. Ordonez.
In: Symposium on Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1347-1368, 1975. 8 fig, 10 ref.

Descriptors: *Model studies, *Estuaries, *Deposition(Sediments), Computer models, Sediment transport, Rivers, Tidal waters, Tidal streams, Sediments, Sedimentation, Intakes, Flow, Mathematical models, California.
Identifiers: *Sacramento River(Calif).

A computer modeling technique was developed to study the extent and depth of sediment deposits in tidal rivers downstream from a local source of oversupply of sediment. The model describes the deposits as one-dimensional deltas of uniform height moving in the flow direction according to the varying transport capacity of the river at different discharges and bed elevations. The model incorporates a reorganization of the hydraulic computations in the Einstein Method, for sediment transport calculations in alluvial rivers, to permit the determination of the sediment transport capacity of a given channel with a given discharge, when the depth or velocity in the reach are known. The new procedure does not require a knowledge of the friction slope and is particularly suited for the computation of transport capacities in gradually varied unsteady flow where the hydraulic conditions can be represented by a series of uniform flows during discrete intervals of time. (See also W76-10415) (Sims - ISWS)
W76-10447

COMPUTER SIMULATION OF BEACH EROSION AND PROFILE MODIFICATION DUE TO WAVES,
Delaware Univ., Newark. Dept. of Civil Engineering.
H. Wang, R. A. Dalrymple, and J. C. Shiau.
In: Symposium on Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1369-1384, 1975. 9 fig, 10 ref.

Descriptors: *Model studies, *Beach erosion, *Waves(Water), Computer models, Mathematical models, Littoral drift, Sediment transport, Erosion, Sedimentation, Suspended solids, Tidal effects, Tides, Beaches, Coasts.

The phenomenon of beach erosion has become important in recent years as the coastline has become a focus of human activity. In order that adequate planning in the coastal zone be possible, it is necessary to understand and to model the evolving coastline. A computer model has been developed to predict coastal erosion as a function of input deepwater wave conditions, tidal conditions, and the nearshore present bathymetry. The model predicts sediment transport in the offshore zone due to transport of material by the wave-induced mass transport and in the surf zone, caused primarily by the longshore current. Examples of the capabilities of the model were presented, including the modification of the beach profile with time due to the uneven littoral drift across the surf zone and the alteration of an irregular shoreline with time due to wave and tidal effects. (See also W76-10415) (Sims-ISWS)
W76-10448

PROBLEMS OF PHYSICAL MODEL TESTS WITH HARBOURS,
Danish Hydraulic Inst., Copenhagen.
For primary bibliographic entry see Field 8B.
W76-10451

TWO-DIMENSIONAL FINITE ELEMENT DISPERSION MODEL,
Dames and Moore, Cranford, N.J.
For primary bibliographic entry see Field 5B.
W76-10453

FLOW2D: A TWO-DIMENSIONAL FLOW MODEL FOR FLOOD PLAINS AND ESTUARIES,
Resource Analysis, Inc., Cambridge, Mass.
G. J. Vicens, B. M. Harley, and J. C. Schaake, Jr.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1487-1504, 1975. 6 fig, 4 ref.

Descriptors: *Model studies, *Floods, *Flood plains, *Estuaries, Mathematical models, Finite element analysis, Water levels, Flow, Flood flow, Streamflow, Hydrographs, Hydrology, *Puerto Rico.

In a variety of flood plains and estuaries a one-dimensional analysis of the water movement is inappropriate. For these cases a Two-Dimensional Flow Model (FLOW2D) has been developed. FLOW2D numerically solves the equations of continuity and momentum in finite element form to predict stages and discharges throughout the area of interest. The continuity equation relates the rate of change in water surface elevation to the net rate of instantaneous flow into a segment. A flood plain or estuary is divided into a number of segments. The input data required are: minimum, median, and maximum elevations within each segment; segment size; cross-section descriptions for the boundaries between segments; Manning's n for each of these cross-sections; and flow or water surface hydrographs at the external boundaries. A unique feature of this model, which seeks to minimize the cost of simulation runs while maintaining strict control of the accuracy of the solutions, is a variable time step. Through the use of filter/prediction techniques, the model internally reduces the time step when sharp changes in water surface elevations are occuring. In this manner a more 'detailed' description of these changes is obtained. On the other hand, where no such variations are present, the model increases the time step so as to minimize the cost of the solution. This model has been used to estimate flood elevations in a variety of flood plains in Puerto Rico. In those basins where observed flood elevations were available, the simulated results were in close agreement. (See also W76-10415) (Sims-ISWS)
W76-10454

ANALOGOUS MODELLING OF AQUIFEROUS SYSTEMS IN COASTAL ZONES,
Akademiya Nauk SSSR, Moscow. Interagency Geophysical Committee.
G. V. Bogomolov, Y. G. Bogomolov, and A. M. Soyfer.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1505-1515, 1975. 2 fig, 5 ref.

Descriptors: *Model studies, *Saline water-freshwater interfaces, *Saline water intrusion, Coasts, Aquifers, Analog models, Analog computers, Groundwater, Sea water, Infiltration, Estuaries.

The problem of analog modelling of water-bearing systems in coastal zones was described with application of effective head as the potential function during boundary displacement of fresh and salt waters. The paper also presented peculiarities of solution of an inverse problem and an example of solution of a test problem. (See also W76-10415) (Sims-ISWS)
W76-10455

NUMERICAL MODEL FOR STORM SURGE AND TIDAL RUN-UP STUDIES,
Dames and Moore, Los Angeles, Calif. Advance Technology Group.
A. K. Runchal.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1516-1534, 1975. 7 fig, 10 ref.

Descriptors: *Model studies, *Storm surge, *Tidal waters, Mathematical models, Mud flats, Tidal marshes, Beaches, Reservoirs, Winds, Pressure, Friction, Coriolis force, Waves(Water), Algorithms, Flow, Water circulation, Numerical analysis, Simulation analysis.
Identifiers: *Tidal run-up.

The mathematical and numerical basis of a computational model developed for study of run-up and draw-down on tidal flats was described. The model is based upon the 'shallow water' theory and accounts for the presence of coriolis force, basin friction, wind stresses, and pressure gradients. The mathematical model is pseudo-two-dimensional in nature in that the gradients of the variables are assumed negligible in a direction normal to that of the main concern. The resulting algorithm is especially efficient and economical. Unlike many other numerical algorithms, the present one was found to be especially suited for preserving the characteristic wave speeds and amplitudes of the solution. It has been tested with a number of trial problems and found to provide results which accord well with the available approximate or analytic solutions. (See also W76-10415) (Sims-ISWS)
W76-10456

NUMERICAL SIMULATION OF STORM SURGES IN BAYS,
Danish Hydraulic Inst., Horsholm.
A. Damsgaard, and A. F. Dinsmore.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1535-1551, 1975. 9 fig, 2 tab, 4 ref.

Descriptors: *Model studies, *Storm surge, *Coasts, *Florida, Mathematical models, Hurricanes, Storms, Winds, Waves(Water), Floods, Flood plains, Bays, Estuaries, Barrier islands, Tides, Wind tides, Numerical analysis, Simulation analysis.
Identifiers: *Biscayne Bay(Fla), *Hurricane Betsy.

A two-stage approach for numerical simulation of storm surges in complex coastal areas has been adopted by the Danish Hydraulic Institute. The first stage simulates the open coast surge on a large and relatively coarse model including enough area that the surge is generated entirely within the model. The second stage routes the open coast surge into the nearshore area and superimposes the locally generated surge on top of the open coast surge. This method is particularly suited to simulation of surges in such complex areas as bays and estuaries partly sheltered by barrier reefs, low-lying barrier islands, which might be overtopped at some stage during the surge, and inundated flood plains. It has been applied to design hurricane simulations in Biscayne Bay, Florida, and Darwin, Australia, among other locations. Both model stages are based on DHI's computer system 'System 21' which computes the flows and water levels in a model of the area under study using a finite difference method for solution of the equations of continuity and momentum for nearly-horizontal two-dimensional flows. The area may be of quite arbitrary shape and bathymetry. (See also W76-10415) (Sims-ISWS)
W76-10457

PORTABLE BREAKWATER WITH SHIP HULKS,
Dames and Moore, New York.
For primary bibliographic entry see Field 8B.
W76-10459

MODELING OF INLET-BAY SYSTEMS IN RELATION TO SAND TRAPPING,
Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
D. B. King, and O. H. Shemdin.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1623-1637, 1975. 12 fig, 4 ref. ONR NR-388-106 ONR N00014-A-0173-0020

Descriptors: *Model studies, *Inlets(Waterways), *Bays, *Sedimentation, Mathematical models, Channels, Estuaries, Littoral, Rivers, Coasts, Tides, Tidal waters, Sands, Sediment transport, Sediments, Hydraulics.

Models of inlet-bay systems were considered through the use of the equations of motion and continuity. The models include inertia in the inlet, changing cross sectional area in the inlet, changing surface bay area and considers river discharge. Previous analytical models simplify such considerations and predict symmetric flows in and out of inlets over a tidal cycle. The nonlinear friction in the inlet coupled with the above considerations produce asymmetric flows over a tidal cycle of varying degrees. The sediment transport capability of inlets were considered in terms of power of the flow rates. The inlet-bay systems were interpreted in light of their capability to trap sand from the littoral zone. It was found that some inlets behave as sinks and others eject sand to the ocean. This depends on the repletion coefficient as defined by Keulegan and on whether the inlet cross sectional area or bay surface area increase with the tidal elevation as in marsh regions. The sand trapping capability was also investigated in light of the phase shift between the ocean tide and the inlet current. The model results were discussed in light of observations obtained from Florida inlets. (See also W76-10415) (Sims - ISWS)
W76-10462

LCHF COASTAL SEDIMENT MODELING TECHNIQUES,
Laboratoire Central d'Hydraulique de France, Paris.
C. Migniot, C. Orgeron, and F. Biesel.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1638-1657, 1975. 18 fig.

Descriptors: *Model studies, *Coasts, *Sediment transport, Hydraulic models, Analytical techniques, Waves(Water), Currents(Water), Winds, Sands, Erosion, Sedimentation, Harbors, Breakwaters, Structures, Littoral drift, Beaches, Estuaries, Reviews.

Systematic studies of the complex motions induced by waves, currents and wind action have to be made for a large variety of projects including large or recreational harbors and coast protection works. Except for the simplest cases, scale model techniques remain the only reliable and economical means to forecast the effect of a maritime structure on bottom topography and to optimize the layout in order to suppress or minimize unwanted accretion or erosion. For the last thirty years, the Laboratoire Central d'Hydraulique de France (L.C.H.F.) has been developing a scale model technology allowing this kind of research to be carried out with a good accuracy. The present paper sets forth these techniques and shows examples comparing forecasts obtained with models with actual observed evolution. (See also W76-10415) (Sims - ISWS)
W76-10463

FLOATING STRUCTURE ARRANGEMENT,
For primary bibliographic entry see Field 8A.
W76-10465

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SEWAGE HANDLING AND DISPOSAL PROCESS FOR CHLORIDE (NACL) CONTAMINATED SLUDGES,
Dorr-Oliver Inc., Stamford, Conn. (Assignee).
For primary bibliographic entry see Field 5D.
W76-10205

COMPOSITE SEMIPERMEABLE MEMBRANES MADE FROM POLYETHYLENIMINE,
Universal Oil Products Company, Des Plaines, Ill. (Assignee).
W. J. Wrasidlo.
U. S. Patent No. 3,951,815, 5 p, 15 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1350, April 20, 1976.

Descriptors: *Patents, *Desalination, *Reverse osmosis, Membranes, Membrane processes, Waste water treatment, *Water pollution treatment, Water quality control, Water purification, Semipermeable membranes, Thin films, Chemical reactions.
Identifiers: Composite semipermeable membranes, Ultrathin films.

The object of the invention is to provide an improved method for making composite semipermeable membranes having good salt rejection characteristics in which membranes are resistant to deterioration. By employing a film-forming polymer having a plurality of reactive amino or hydroxyl groups, and by treating this polymer with a monomer which will cross-link the polymer, rather than react with two groups on the same molecule, ultrathin films can be created which have effective salt-rejecting capability and are thus useful in the creation of composite semipermeable membranes. When polyethylenimine is used, it may first be reacted with an appropriate amount of acrylonitrile under conditions which assure cyanoethylation of substantially all of the primary amino groups or the polyethylenimine may first be cross-linked and then reacted with acrylonitrile or a suitable reactant. This is a standard graft polymerization reaction and is carried out under known conditions. After the cyanothylation is complete, an appropriate water solution of the graft polymer is prepared, and a microporous substrate is soaked in this solution for a sufficient period of time. The reaction of the polyamine with the dicyl halide or some other monomer, is allowed to proceed for an appropriate period of time to assure that cross-linking to the extent desirable is achieved. (Sinha - OEIS)
W76-10485

3B. Water Yield Improvement

FIELD RESEARCH AND TESTING OF A WATER HAND PUMP FOR USE IN DEVELOPING COUNTRIES,
Battelle Columbus Lab., Ohio.
For primary bibliographic entry see Field 8G.
W76-10086

FRESH WATER CAN BE STORED IN SALINE AQUIFERS,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 4B.
W76-10107

3C. Use Of Water Of Impaired Quality

EFFECTS OF TREATED MUNICIPAL WASTEWATER ON OAT FORAGE AND GRAIN,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 5D.
W76-10119

USE OF SALINE WATER IN AGRICULTURE. I. DESCRIPTION OF THE SYSTEM,
Central Arid Zone Research Inst., Jodhpur (India).
R. P. Dhir, and O. P. Bhatia.
Annals of Arid Zone, Vol. 14, No. 3, p 206-211, September, 1975. 4 tab, 9 ref.

Descriptors: *Saline water, *Irrigation wells, *Irrigation practices, *Water management(Applied), *Arid lands, *Saline water systems, Crop production, Fallowing, Wheat, Barley, Groundwater, Sodium, *Salt tolerance.
Identifiers: *Rajasthan, India(Pali district), Raya, Jowar.

Details are presented of an irrigation system developed in western Rajasthan, India, using saline to highly saline sodic underground waters considered unfit for such purposes by all available water quality standards. Data were collected from 37 sites concerning water and soil characteristics, management practices and duration of well use. Irrigation using saline and sodium well water has increased over the last 50 years in this region; 90-95% of the wells were in use between 1970 and 1973; loam to clayey texture soils, from 60-90 cm deep were most commonly irrigated. Lands irrigated with waters below 5 mmhos are usually double cropped, while those under higher salinity irrigation are used in rotation with a fallow period (generally 18 mo) between applications allowing natural amelioration of soil through rainfall. Wheat is the most popular crop and is sometimes grown with barley; when waters below 5 mmhos are used, raya, jowar and maize are also grown. (Jahns-Arizona)
W76-10168

SEED GERMINATION AND EARLY SEEDLING GROWTH OF WHEAT (TRITICUM AESTIVUM LINN.) CV. 1553 UNDER THE INFLUENCE OF SALINITY AND PLANT-GROWTH HORMONES,
Swami Shradha Nand Coll., Alipur (India).
V. R. Babu, and S. Kumar.
Annals of Arid Zone, Vol. 14, No. 3, p 221-228, September, 1975. 4 tab, 11 ref.

Descriptors: *Seed treatment, *Germination, *Salt tolerance, *Plant growth regulators, *Soil-water-plant relationships, Wheat, Moisture content, Root development, Salinity, Plant growth.
Identifiers: Benzyl adenine, Kinetin, Osmotic stress, India.

Plant hormones benzyl adenine and kinetin promoted wheat seed (Triticum aestivum Linn. cv. 1553) germination and survival under osmotically stressed conditions of soil salt solutions up to 3.5%. The utilization of seed reserves decreased as soil salt concentrations increased. This inhibitory effect could be overcome up to 1% of salt solution by adding benzyl adenine and kinetin. Seedlings survived as long as 8 days in the 2.5 - 3.5% salt concentration range utilizing the assimilates in solution with hormones. The hormones had a corrective influence in seedling dry matter mobilization up to 1.5% soil solutions. Seedling water content also increased. Root and shoot elongation rates under test conditions were comparable to controls grown in distilled water, with hormone-treated seedlings at a 1% salt concentration having a greater shoot elongation than controls. Root elongation rates were higher in salt solutions with benzyl adenine than with kinetin. Increased water content may have been due to enhanced membrane permeability resulting from hormonal influence. (Jahns-Arizona)
W76-10169

OBSTACLES TO THE DEVELOPMENT OF ARID AND SEMI-ARID ZONES.
For primary bibliographic entry see Field 3F.
W76-10179

GEOTHERMAL POWER METHOD,
J. S. Swearingen.
U.S. Patent No. 3,951,794, 9 p, 3 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1343, April 20, 1976.

Descriptors: *Patents, *Geothermal studies, Thermal properties, *Scaling, *Heat exchangers, Heat transfer, Energy, Suspensions, Suspended solids, Impaired water quality.

The object of this invention is to provide a system and method of extracting heat from hot unrefined water by passing it directly through a conventional heat exchange apparatus. Scaling and other solid build-up of impurities from the water is prevented in the hot water well casing and water transport equipment as well as in the heat exchange equipment. The heat exchanger surface may be the surfaces of a conventional heat exchanger such a tube and shell or they may be the surfaces of the porous material in an accumulator-type heat interchanger. The improvement involves adding to the hot unrefined water an agent capable of increasing the formation of non-scale-forming species of the scale- forming impurities so that scaling and other solid build-up on the heat exchange surface, particularly upon cooling of the water, is minimized. Non-scale-forming species are those which remain in solution or suspension in the unrefined water as it is passed through the heat exchange apparatus without forming scale and/or those which are harmlessly precipitated, e.g. solid non-scale particles which are small enough to remain in suspension in the moving water and be carried out of the heat exchange apparatus. (Sinha -OEIS)
W76-10470

CHANGE OF WATER REGIME AND CONTENT OF MOBILE FORMS OF N, K, MN AND FE IN MEADOW-PEAT SOIL OF THE RAMENSK FLOODPLAIN OF THE MOSCOW RIVER IN CONNECTION WITH AGRICULTURAL USE, (IN RUSSIAN),
Nauchno-Issledovatelskii Institut Ovoshchnogo Khozyaistva, Moscow (USSR).
For primary bibliographic entry see Field 2G.
W76-10477

3D. Conservation In Domestic and Municipal Use

TACOMA'S NORTH FORK WELLS.
For primary bibliographic entry see Field 4B.
W76-10089

HYDROLOGIC DATA FOR URBAN STUDIES IN THE FORT WORTH, TEXAS METROPOLITAN AREA, 1974,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W76-10141

HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1974,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W76-10145

URBAN SERVICE PRICING AND LAND USE: SOME PRELIMINARY RESULTS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 6C.
W76-10193

RECIRCULATING SEWERAGE SYSTEM,
Koehler-Dayton, Inc., New Britain, Conn. (Assignee).
For primary bibliographic entry see Field 5D.
W76-10209

SYSTEM FOR TOTAL DIRECT RECYCLE OF SECONDARY MUNICIPAL WASTEWATER, VOL I -- DESIGN CONCEPTS,
Houston Research, Inc., Tex.
For primary bibliographic entry see Field 5D.
W76-10257

APPLICATION OF A WATER QUALITY MODEL TO THE DENVER METROPOLITAN AREA,
Black and Veatch, Denver, Colo.
For primary bibliographic entry see Field 5B.
W76-10438

3E. Conservation In Industry

COAL GASIFICATION IN SOUTHEASTERN OHIO: WATER SUPPLY AND DEMAND,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
E. E. Whitlatch, Jr.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-254 836, $5.00 in paper copy, $2.25 in microfiche. Ohio Water Resources Center, Columbus, Project No. 489X, Completion Report, September 1975. 77 p, 53 ref. OWRT A-041-OHIO(1).

Descriptors: *Water requirements, *Consumptive use, *Water supply, *Ohio, *Cost comparisons, Sites, Linear programming,*Optimization, *Energy, *Natural gas, Coal mines, Reservoirs, Groundwater conjunctive use, *Water demand, Optimum development plans, Water transfer, Water values, Solid wastes, Reviews.
Identifiers: *Coal gasification, Southeastern Ohio, High-Btu gas, Low-Btu gas, Synthetic natural gas, Gas transport, Gas cost, Gas supply, Gas demand, Coal supply.

A general review of the need for coal gasification is made at the National level and for the State of Ohio. Current State energy policy promotes the construction of both low and high-Btu coal gasification plants. Water requirements of such an industry are estimated and water availability is determined for Southeastern Ohio. Direct stream use, reservoir and groundwater sources are compared economically. Linear programming optimization models are also developed for the coal gasification siting problem. These incorporate the cost of plants, gas transmission, coal supply and transport, solid waste disposal and water supply. The estimated range of consumptive water use in a 250 million cubic feet per day, high-Btu plant, is from 7 to 45 million gallons per day (MGD). The most likely consumptive water use for such a plant in Southeastern Ohio is 25 MGD. A generalized cost analysis of three alternative water supply sources indicates that a direct stream source would very likely be the least expensive alternative, followed by reservoir and groundwater sources. The respective costs of these were calculated to be 17.9, 25.4, and 27.2 cents per 1000 gallons. At a gas price of $1.50 per 1000 cubic feet, the cost of water would generally represent from 1.2 to 1.8 percent of the final gas price. Mathematical models of the energy facility siting process can be developed and would be useful in the comparison of alternative trade-offs between low-Btu and high-Btu coal gasification plant construction. The Federal government should support a detailed study of water use and conservation in both the Lurgi and advanced technology processes. Site-specific reconnaissance should be carried out in the selected study area for both reservoir sites and potential groundwater aquifers capable of supplying a coal conversion industry.
W76-10002

COST FUNCTIONS FOR ADDITIONAL GROUND WATER DEVELOPMENT,
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 4B.
W76-10194

POLLUTANT ANALYSIS COST SURVEY,
National Bureau of Standards, Washington, D. C.
For primary bibliographic entry see Field 5A.
W76-10259

3F. Conservation In Agriculture

WATER QUALITY DATA FROM TRUCKEE AND CARSON RIVERS. PYRAMID LAKE AND LAHONTAN RESERVOIR, A WORKING PAPER.
Environmental Protection Agency, San Francisco, Calif.
For primary bibliographic entry see Field 5C.
W76-10054

ALFALFA SAFEGUARDS GROUND WATER.
For primary bibliographic entry see Field 5G.
W76-10093

PUDDLING TROPICAL RICE SOILS: 2. EFFECTS OF WATER LOSSES,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
P. Sanchez.
Soil Sci. 115(4), p 303-308, 1973.

Descriptors: *Puddling, Cultivation, *Rice, Root development, *Plant growth, *Soil-water-plant relationships, Drainage effects, *Water loss, Water harvesting, Crop production, Rotations, Crop response.

The advantages of puddling some tropical rice soils are directly or indirectly related with decreasing water losses and not with increasing nutrient-supplying capacity. Puddled flooded treatments produced similar or higher rice yields than other combinations. The limitations of puddling rice soils are in restricting root development when the soil shrinks and cracks at early stages of rice growth in rainfed systems and the slow waterloss patterns after rice harvest which might limit rotations with other crops. When excessive water movement is not a limiting factor, excellent rice performance can be obtained from well-granulated soils.--Copyright 1973, Biological Abstracts, Inc.
W76-10118

SOLUTION PHOSPHORUS CONCENTRATION AND GROWTH OF RICE (ORYZA SATIVA L.) IN FLOODED SOILS,
Texas Agricultural Experiment Station, College Station. Dept. of Soil and Crop Sciences.
L. R. Hossner, J. A. Freeouf, and B. L. Folsom.
Soil Sci Soc Am Proc 37(3), p 405-408, 1973.

Descriptors: Soil-water-plant relationships, Nutrient requirements, *Phosphorus, *Plant growth, Fertilization, *Crop response, *Rice, Aquatic soils, Gulf coastal plain, Texas, Growth rates, Flooding.
Identifiers: Oryza-sativa, Flooded soils.

Soil solution P concentration was monitored at weekly intervals during the vegetative growth of O. sativa L. cv. 'Bluebelle' on flooded soils from the gulf coast region of Texas. Significant increases in dry matter production were obtained from application of phosphate fertilizer. Average soil solution P concentration ranged 0.02-5.28 ppm when all soils and P fertilization rates were considered. A linear relationship was obtained between the logarithm of the average soil solution P concentration and the P concentration or P uptake of the plant. Yields were greater than 90% of maximum when the average soil solution P concentration was greater than 0.1 ppm. The concentration of P in the plat tissue at 0.1 ppm soil solution P was 0.25%.--Copyright 1973, Biological Abstracts, Inc.
W76-10122

DIFFERENT LEVELS OF SOIL ORGANIC MATTER IN DESERT SOIL AND NITROGEN FERTILIZER ON YIELDS AND MINERAL COMPOSITION OF BARLEY GROWN IN THE SOIL,
California Univ., Los Angeles. Div. of Environmental Biology.
E. M. Romney, A. Wallace, J. W. Cha, and J. D. Childress.
Communications in Soil Science and Plant Analysis, Vol. 7, No. 1, p 51-55, 1976. 2 tab, 9 ref.

Descriptors: *Sierozems, *Soil environment, *Organic matter, *Crop response, *Barley, Soil moisture, Plant growth, Vegetation effects, Fertilizers, Soil types, Plant physiology, Nitrogen, Soil amendments.

Barley plants (Hordeum vulgare L. cultivar Atlas 57) were grown for 30 days in desert soil from bare areas (low soil organic matter) and from beneath long-established shrubs (moderately high soil organic matter). Plants were grown in pots with three replicates, with and without nitrogen fertilizer, watered daily and maintained at near 1/3 bar soil moisture or higher. Those produced in soil from under shrubs had three times greater dry weight than those grown in low organic matter soil with N added. Silicon levels of high organic soil plants were reduced by N fertilizer and were greater in plants from low organic matter soil with and without N. Shoot concentrations of iron, Al and Zn were positively correlated with N concentrations and negatively with those of Si. Mn levels were higher in plants from low soil organic matter; calcium was positively correlated with shoot concentrations of Ba. (Jahns-Arizona)
W76-10170

WATER QUALITY IMPLICATIONS OF CATTLE GRAZING ON A SEMIARID WATERSHED IN SOUTHEASTERN UTAH,
Oregon State Univ., Corvallis. Rangeland Resources Program.
For primary bibliographic entry see Field 5G.
W76-10171

CENTER-PIVOT IRRIGATION,
W. E. Splinter.
Scientific American, Vol. 234, No. 6, p 90-99, June 1976. 9 fig.

Descriptors: *Irrigation, *Sprinkler irrigation, *Irrigation efficiency, *Pasture management, *Crop production, Land use, Soil moisture, Arid lands, Soil management, Economic feasibility, Irrigation practices, Irrigation systems.
Identifiers: *Center-pivot irrigation.

The center-pivot system involves irrigation of circular fields using a series of sprinklers mounted on a pipe supported by a row of mobile towers and rotated to distribute water supplied by a central well. Sprinklers are spaced so that the water is applied at increasing rates with distance outward along the pipe. The advantages are its automatic

operation on large tracts, minimized application, design for the quarter section (160 acres) and the ability to irrigate lightly and frequently. The last feature is especially advantageous with coarse or sandy soil; moisture in the root zone is replenished sufficiently to allow intensive cropping on such soils. Pasture irrigated by this system has proved dramatically more productive. Fertilizers can be injected into the water supply line to administer nutrients as needed. Some disadvantages are the substantial energy requirements and possible depletion of underground water reservoirs. The economic potential is analyzed, and some advantageous methods of application are presented. (Jahns-Arizona)
W76-10173

EFFECT OF CULTURAL PRACTICES ON GRAIN YIELD AND YIELD COMPONENTS IN IRRIGATED WHEAT,
Arizona Univ., Tucson. Dept. of Agronomy and Plant Genetics.
A. D. Day, A. Alemu, and E. B. Jackson.
Agronomy Journal, Vol. 68, No. 1, p 132-134, January-February, 1976. 3 tab, 13 ref.

Descriptors: *Wheat, *Crop response, *Growth rates, *Crop production, *Planting management, Arizona, Water management(Applied), Irrigation effects, Cultivation, Plant growth.

Experiments at Yuma, Arizona, evaluated effects on wheat (Triticum aestivum) production of planting methods and different cultural practices. Two planting methods (on the flat and on beds), 3 seeding rates (29, 58 and 87 kg/ha) and 4 row positions on beds (north, south, east and west) were studied. Flat and bed methods produced similar wheat grain yields and grain volume weights; seeding rates had little net effect on those results, although the low seeding rate resulted in more wheat seed per head and fewer heads/unit area than higher rates. Beds with an east-west orientation produced more heads/unit area, more seed/head and higher grain yields than those running north-south. The south row position on east-west beds had better results than the north position except in seed weight response which was unaffected. Higher seeding rates on north-south beds produced heavier seeds. Row position on north-south beds did not affect head/unit area values and grain yields. Results suggest that wheat grown on north-south beds should have lower seeding rates for economical production. (Jahns-Arizona)
W76-10176

FERTILIZATION, NUTRIENT COMPOSITION, AND YIELD RELATIONSHIPS IN IRRIGATED SPRING WHEAT,
Arizona Agricultural Experiment Station, Yuma. Dept. of Soils, Water, Engineering and Plant Sciences.
B. R. Gardner, and E. B. Jackson.
Agronomy Journal, Vol. 68, No. 1, p 75-78, January-February, 1976. 3 fig, 5 tab, 5 ref.

Descriptors: *Nitrates, *Fertilization, *Crop response, *Nutrient requirements, *Wheat, Arizona, Root zone, Crop production, Testing procedures, Plant tissues, Phosphates.

The effect of N fertilization on the growth and yield of semidwarf spring wheat (Triticum aestivum L.) in the Yuma Valley of southwestern Arizona and a tissue test as guide for applying such fertilizers is presented. Excessive N used is evaluated, in two field experiments reduced yields slightly when compared with sufficient N levels. Application of 336 kg N/ha produced the best yields, with no further increase resulting from higher rates. Yields intermediate between control and high-yield results were achieved with 112 and 224 kg/ha rates prior to planting; similar results at those two rates suggest much of the N applied preplant was leached from the root zone. N caused increases in number of heads/unit area and seeds/head, with a decrease in the weight of individual seeds. Total N content in the grain increased with larger N applications. Determination of P in the lower portion of wheat stems was of doubtful value in determining the crop's P status. (Jahns-Arizona)
W76-10177

OBSTACLES TO THE DEVELOPMENT OF ARID AND SEMI-ARID ZONES.
Nature and Resources, Vol. 11, No. 4, p 2-11, October-December, 1975. 1 fig.

Descriptors: *Arid lands, *Semiarid climates, *Land development, *Comprehensive planning, *Land use, Livestock, Sheep, Irrigation efficiency, Irrigation effects, Rainfall, Tourism, Human population, Social aspects, Crop production, Salinity, Salt tolerance.

Difficulties of animal husbandry, irrigation, rainfall cultivation, urban growth, industrial development and tourism within arid and semi-arid zones are discussed and some solutions offered. Arid zone problems are somewhat easier to contend with since specific solutions are based on divisionof arid areas into specialized land use units. Semi-arid zone development involves conflict between various methods (agriculture or animal husbandry), and population density increases complicate the decision-making process. Animal husbandry problems include those of climate, over-grazing, over-population, pastoral vs. agricultural orientations, loss of grazing land and livestock marketing complications. Irrigation produces harmful side-effects, salinization, soil cultivation and health factors. Rainfall cultivation is complicated by variable precipitation, erosion, animal husbandry and crop cultivation, and crop rotation. These and other obstacles to arid and semi-arid zone development are described. Proposals for specific management programs are outlined and recent innovations explored. (Jahns-Arizona)
W76-10179

ARIZONA'S WATER SUPPLY-SOME REFLECTIONS,
Arizona Bureau of Mines, Tucson.
For primary bibliographic entry see Field 4A.
W76-10183

YIELD-NUTRIENT ABSORPTION RELATIONSHIPS AS AFFECTED BY ENVIRONMENTAL GROWTH FACTORS,
National Fertilizer Development Center, Muscle Shoals, Ala.
For primary bibliographic entry see Field 2I.
W76-10184

MOISTURE USE EFFICIENCY OF DRYLAND CROPS AS INFLUENCED BY FERTILIZER USE II. RABI CEREALS,
Indian Agricultural Research Inst. New Delhi.
R. P. Singh, and Y. S. Ramakrishna.
Annals of Arid Zone, Vol. 14, No. 3, p 263-267, September, 1975. 1 tab.

Descriptors: *Application methods, *Fertilizers, *Water utilization, *Crop response, *Dry farming, Consumptive use, Water requirements, Nitrogen, Soil-water-plant relationships, Wheat, Barley, Crop production, Agronomy, Water conservation.

A study was conducted for two seasons (1969-70 and 1970-71) at the Indian Agricultural Research Institute, New Delhi, to test the response of wheat (Kalyan Sona) and barley (EB3/Ratna) grown on conserved soil moisture to graded levels of nitrogen (20, 40, 60 and 80 kg N/ha) and three methods of N application (broadcast, placement and 1/2 soil plus 1/2 foliar). Wheat and barley tested had 32-47% greater moisture use efficiency than controls when fertilized with 40 kg N/ha. The half-soil (drilled) plus half-foliar method of fertilizer application produced greater moisture use efficiency with wheat, and both that method and a placement technique were superior to the broadcast method with barley. Exact figures are given for crop response to various levels of nitrogen and application methods, and for total consumptive use, yield of grains, value of grains, and moisture use efficiency. (Jahns-Arizona)
W76-10186

1975 ARIZONA AGRICULTURAL STATISTICS.
Agricultural Research Service, Tucson, Ariz. Statistical Reporting Service.
Arizona Crop and Livestock Reporting Service Bulletin S-11, March, 1976. 71 p, 105 tab, 1 fig.

Descriptors: *Agriculture, *Crop production, *Statistics, *Arizona, *Weather data, *Livestock, *Water supply, *Reservoir yield, Rainfall, Reservoir storage, Soil moisture, Colorado River Basin, Profit.
Identifiers: Gila River Basin(Ariz), Salt River(Ariz).

A compilation of statistics is presented on Arizona agricultural production between 1968 and 1975, a summary of weather, crop and livestock conditions in 1975, and a water supply outlook for the state. Total rainfall for 1975 was below normal at most reporting stations, but a few mountain stations were slightly above average. Estimated crop sales amounted to $607.5 million or 1% below the 1974 level; this decrease was due to lower prices for some crops and reduced quantities in certain cases. Livestock and livestock products brought $618.5 million, or 6% greater than the 1974 total. Reservoir storage totals in the Gila and Colorado River Drainage basins are presented. It is expected that 1976 water supplies will be adequate if normal precipitation continues throughout the season. Heavy rainfall in February accounted for greatly increased flows in the Salt and Gila Rivers. Rain and melting snow have produced good soil moisture at lower and intermediate elevations, and good runoff is expected from normal precipitation in March and April. (Jahns-Arizona)
W76-10187

EFFECT OF WATER REGIME ON PRODUCTIVITY OF CULTIVATED PLANTS, (IN BELORUSSIAN),
R. I. Lashkyevich.
Vyestsi Akad Navuk B SSR Syer Biyal Navuk. 2, p 5-11, 1974.

Descriptors: Productivity, *Moisture content, Peat, *Water tables, Carrots, Corn(Field), *Soil moisture, Cultivation, *Crop production, Peas, Potatoes.
Identifiers: Beets, Cabbage, Peas, Peat, Potatoes.

The results of 16-yr investigations of the effect of the water table and moisture content of peat soils on the yield of agricultural crops are presented. Maintenance of an optimal water table and copious water charging in early spring improved the moisture of the rhizasphere and increased plant productivity even in an area where the groundwater dropped markedly in late summer. Copious moisture in the 1st half of vegetation when the main vegetative mass is formed and much moisture is consumed, considerably improved crop yield. The highest yields of grain crops were obtained at a water table of 50-75 cm, perennial grasses and peas at 50-55 cm, potatoes, carrots and corn at 60-85 cm, and beets and cabbage at 80-105 cm from the soil surface. The optimal water content of peat soil was established: from 75-85% for perennial grasses and from 70-80% for field crops, with its decrease to 70% of the maximum field capacity 30-35 days before harvesting root crops.--Copyright 1975, Biological Abstracts, Inc.
W76-10189

EFFECT OF TILLAGE ON SOIL STRUCTURE AND PLANT GROWTH UNDER RAIN-FED CONDITIONS,
Indian Agricultural Research Inst., New Delhi.
For primary bibliographic entry see Field 2G.
W76-10487

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

DESIGN OF A STORMWATER SEWER BY NONLINEAR PROGRAMMING--1,
Sherbrooke Univ. (Quebec). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W76-10034

WATER QUALITY DATA FROM TRUCKEE AND CARSON RIVERS. PYRAMID LAKE AND LAHONTAN RESERVOIR, A WORKING PAPER.
Environmental Protection Agency, San Francisco, Calif.
For primary bibliographic entry see Field 5C.
W76-10054

IRRADIANCE REDUCTION: EFFECTS ON STANDING CROPS OF THE EELGRASS, ZOSTERA MARINA IN A COASTAL LAGOON,
San Diego State Univ., Calif. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W76-10067

PUDDLING TROPICAL RICE SOILS: 2. EFFECTS OF WATER LOSSES,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W76-10118

EVALUATION AND ADAPTATION OF SELECTED COMPUTER PROGRAMS TO WATER RESOURCE PROBLEMS IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 7C.
W76-10129

BASIN GOVERNANCE,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W76-10130

DESIGN A RIVER BASIN SAMPLING SYSTEM,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W76-10131

SELECTED STREAMFLOW EXPERIENCE GRAPHS FOR SOUTHWESTERN PENNSYLVANIA,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 7C.
W76-10132

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMEO, COLORADO TO CISCO, UTAH: PART 1. DATA SUMMARY,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 7C.
W76-10142

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMEO, COLORADO, TO CISCO, UTAH: PART 2. BASIC DATA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 7C.
W76-10143

HYDROLOGIC DATA FOR LITTLE ELM CREEK, TRINITY RIVER BASIN, TEXAS, 1974,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W76-10144

HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1974,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W76-10145

HYDROLOGIC DATA FOR COW BAYOU, BRAZOS RIVER BASIN, TEXAS, 1974,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W76-10146

HYDROLOGIC DATA FOR NORTH CREEK TRINITY RIVER BASIN, TEXAS, 1974,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W76-10147

HYDROLOGIC UNIT MAP--1974, STATE OF WASHINGTON.
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 7C.
W76-10150

FLOOD PLAIN INFORMATION: CUMBERLAND RIVER, BURKESVILLE, KENTUCKY.
Army Engineer District, Nashville, Tenn.
Prepared for the City of Burkesville and Kentucky Department of Natural Resources, June 1971. 29 p, 5 fig, 7 plates, 6 tab.

Descriptors: *Floods, Flooding, *Flood flow, *River flow, *Flood profiles, *Flood plains, Dams, *Kentucky, Regional flood, Streamflow forecasting, Maximum probable flood, Historic floods, Flood data, Flood frequency, Peak discharge, Flood peak, Flow duration, Snowmelt.
Identifiers: *Cumberland River(KY), Burkesville(KY), Wolf Creek Dam(KY), Intermediate Regional Flood, Standard Project Flood.

Most developed lands subject to flooding in this study area are within the corporate limits of Burkesville. Most land is above flood levels, but there are some commercial and residential developments and a proposed industrial park within the floodway. The Cumberland River drains 17,614 square miles, 6,020 sq mi of this is above Burkesville. Wolf Creek Dam, 34 miles above Burkesville, impounds more than 96% of this drainage area and thus provides excellent protection for Burkesville. Before the dam was finished in 1950 flood stage was exceeded almost once a year but since that time bankfill stage has not been reached. Main periods of potential floods occur in December through April. Records of stream heights in the vicinity of Burkesville are available for years back to 1884, but official data goes back to 1941. The largest flood, in 1826, floated the courthouse out of Burkesville and destroyed many other structures. The highest recent flood occurred in 1946. After building the dam, the highest floodwaters occurred in 1952 when a peak discharge of 57,000 cubic feet per second was recorded. In an Intermediate Regional Flood a peak discharge of 64,000 cfs is expected along with water velocities of up to 5 ft/sec. This flood would last 24 hours. A Standard Project Flood would produce a peak discharge of 90,000 cfs with slightly higher channel velocities. This flood would last about 48 hours, considerably less than floods before Wolf Creek Dam was built. There are no significant obstructions to flood flow within the study reach. (Smith - North Carolina)
W76-10151

FLOOD PLAIN INFORMATION: EAST ARM LITTLE CALUMET RIVER, SALT CREEK-COFFEE CREEK, PORTER COUNTY, INDIANA.
Army Engineer District, Chicago, Ill.
Prepared for the Northwestern Indiana Regional Planning Commission, March 1975. 32 p, 12 fig, 20 plates, 10 tab.

Descriptors: *Floods, *Flooding, Flow characteristics, *Flood protection, *Non-structural alternatives, *Flood plain zoning, Planning, Flood damage, Floodways, Flood plains, Obstructions to flow, *Indiana.
Identifiers: *East Arm Little Calumet River(IN), Porter County(IN), Intermediate Regional Flood, Standard Project Flood, Flood Plain Management Program, Salt Creek(IN), Coffee Creek(IN).

The portion of Porter County covered by this report is subject to flooding from the East Arm Little Calumet River and its tributaries, Salt and Coffee Creeks. The flood plains are primarily residential and agricultural with extensive open spaces currently under pressure for development. Coffee Creek, flowing in a northwesterly direction for 8 miles to its confluence with the river, slopes about 13 feet per mile with a 4 to 5 foot wide channel. Salt Creek, flowing northerly, slopes at an average of 5.2 ft/mi. Total drainage area is 150.1 square miles. The river, with a 3.3 ft/mi gradient, has 10 to 15 foot wide channels. March and April are months of heaviest runoff, but floods occur in all seasons due to excessive rainfall. Floods can rise to peak in a relatively short period of time. Thirty-four bridges and culverts obstruct large flood flows. State and county regulations require prior approval of construction in floodways. The county is expected to adopt flood zoning ordinances in the near future. The most damaging floods, in 1923 and 1954, caused inundation of bridges and several deaths. In 1954 the East Arm Little Calumet River had a peak discharge of 3,110 cubic feet per second. An Intermediate Regional Flood and Standard Project Flood would have peak discharges of 4,240 cfs and 15,000 cfs, respectively, at the existing streamgage. Flood flows from these streams would cover large areas in Chesterton and Porter, damaging residential and commercial properties and private and public utilities. (Salzman - North Carolina)
W76-10152

FLOOD PLAIN INFORMATION: LITTLE EAGLE CREEK AND TRIBUTARIES, MARION COUNTY, INDIANA.
Army Engineer District, Louisville, Ky.
Prepared for Marion County Metropolitan Planning Department and Indianapolis Flood Control District, June 1971. 46 p, 18 fig, 8 plates, 13 tab.

Descriptors: *Floods, *Flooding, *Flood stages, Flow characteristics, *Flood plains, *Flood protection, *Non-structural alternatives, Control structures, Diversion structures, Historic floods, Flood data, Peak discharge, Flood damage, Planning, Flood plain zoning, Obstructions to flow, Streamflow forecasting, *Indiana.
Identifiers: Little Eagle Creek(IN), Marion County(IN), Falcon Creek(IN), Dry Run(IN), Dry Run Diversion(IN), Intermediate Regional Flood, Standard Project Flood.

This report covers a study reach of 11.21 miles of the Little Eagle Creek and 9.58 miles of Falcon and Guion Creeks, Dry Run and Dry Run Diversion which flow through urban and suburban areas of Speedway and Indianapolis, IN. Having a total drainage area of 26.9 square miles, the streams contain all forms of development in their flood plains which vary in width from 200 feet to 1000 feet, with those of the tributaries being narrower. Flooding occurs during all seasons resulting from heavy rains in winter and early spring and severe thunderstorms in summer and fall. Floods are relatively short with generally high rates of rise. Many bridges and 3 dams obstruct flood flows which can reach 10 ft/sec in the channels. Flood control structures include a diversion channel from Dry Run to Little Eagle Creek and proposed channels, storm sewers, diversion channels and structures for all streams. State and local regulations prohibit construction in the floodways without prior approval. Since the establishment of a stream gage in 1959 the greatest flood occurred in April 25, 1961 cresting at 718.3 feet msld with a peak discharge of 1940 cubic feet per second on Little Eagle Creek. An Intermediate Regional Flood and Standard Project Flood on Little Eagle Creek are estimated to crest at 727.6 ft and 730.7 ft respectively, and have peak discharges of 9,000 cfs and 14,500 cfs. An IRF would rise to peak in 13 hours and remain 7 hours above bankfull, and the SPF would rise in 65 hours and last 20 hrs. (Salzman - North Carolina)
W76-10153

FLOOD PLAIN INFORMATION: CROOKED CREEK AND WILLIAMS CREEK, MARION COUNTY, INDIANA.
Army Engineer District, Louisville, Ky.
Prepared for Marion County Metropolitan Planning Department and Indianapolis Flood Control District, June 1970. 39 p, 18 fig, 7 plates, 7 tab.

Descriptors: Floods, Flooding, *Flash floods, *Flood flow, *Historic floods, *Flood stages, Flow characteristics, *Flood plains, Flood protection, *Non-structural alternatives, Planning, *Indiana, Flood data, Peak discharge, Flow duration, Building codes, Flood plain zoning, Obstructions to flow, Streamflow forecasting.
Identifiers: Indiana Flood Control Act, Crooked Creek(IN), Williams Creek(IN), Marion County(IN), Intermediate Regional Flood, Standard Project Flood.

Covering a distance of 14.6 miles, the Crooked and Williams Creeks drain 42.3 sq mi on the west side of the West Fork White River. The creeks flow in a southerly direction with slopes of 14.2 ft/mi on Crooked Creek and 16.8 ft/mi on Williams Creek. Residential and undeveloped areas are in the flood plains which range from 400 ft to 1500 ft wide. Most floods occur between January to April resulting from general heavy rains; however, intense local thunderstorms can cause flash flooding. With velocities ranging up to 13 ft/sec in the channel, floods last for a short time in upper reaches, while longer periods of flooding occur in the lower reaches due to backwater effects of the river. Flood damage prevention measures include county and state regulations which require approval of any construction in the floodways. Obstructions to flood flow include 36 bridges as well as heavy vegetation. The greatest flood occurred in 1957 with peak discharges of 4,000 cubic feet per second and 1500 cfs on Crooked and Williams Creeks, respectively. An International Regional Flood and Standard Project Flood would have peak discharges of 8,050 cfs and 15,500 cfs on Crooked Creek and 8,200 cfs and 17,000 cfs on Williams Creek. Velocities typical of both creeks are 13 ft/sec in the channel with 5 ft/sec in the overbank during an IRF; for the SPF, 18 ft/sec in the channel with 7 ft/sec overbank. (Salzman - North Carolina)
W76-10154

FLOOD PLAIN INFORMATION: TURKEY AND JOPLIN CREEKS, JOPLIN, MISSOURI.
Army Engineer District, Tulsa, Okla.
Prepared for the City of Joplin, September 1973. 41 p, 9 fig, 18 plates, 5 tab.

Descriptors: *Floods, *Flood profiles, *Flow characteristics, *Flood plains, Flooding, Streamflow forecasting, Historic floods, Peak discharge, Flow duration, Flashfloods, Obstructions to flow, Dikes, Channel improvement, *Missouri,
Identifiers: Turkey Creek(MO), Joplin Creek(MO), Joplin(MO), Standard Project Flood, Intermediate Regional Flood.

The flood plains of the two creeks of this study area are partially covered with residential, commercial and industrial development. Of particular importance are the Turkey Creek Sewage Treatment Plant, Ozark Bible College and part of a shopping center along Turkey Creek. Joplin Creek, with a drainage area of 6.4 square miles, is a tributary of Turkey Creek which drains 49 sq mi. Continued growth of the watershed will probably intensify land use in the flood plains. The majority of flood producing storms over these watersheds occur during the spring and early summer months. Flooding generally results from intense storms of short duration. Stream gage records are available continuously since 1963. Large floods have occurred 5 times since 1943 and caused rather extensive damages due to the conditions in the flood plain. In the event of an Intermediate Regional Flood peak discharges of 7770 cubic feet per second and 11,800 cfs are expected on Joplin and Turkey Creeks, respectively, along with channel velocities up to 7 ft/sec in Joplin Creek and 9 ft/sec in Turkey Creek. Overbank velocities will average 1 to 3 ft/sec. During a Standard Project Flood peak discharges of 13,400 and 21,500 cfs are expected on Joplin and Turkey Creeks, respectively. Channel velocities could average up to 8 ft/sec in Joplin Creek and 10 ft/sec in Turkey Creek. Maximum velocities, occurring near bridges, could be up to 16 ft/sec. Floods on Joplin Creek would last 4 hours and on Turkey Creek up to 30 hours. Many of the bridges and culverts in the area are obstructive to flow. Flood protection measures include some channel improvement, protective dikes around sewage treatment plant, and park land in the flood plain. (Smith-North Carolina)
W76-10155

FLOOD PLAIN INFORMATION: PORTAGE OPEN BAY AND MAIN DITCH, VICINITY OF PORTAGEVILLE, MISSOURI.
Army Engineer District, Memphis, Tenn.
Prepared for the City of Portageville, September 1972. 23 p, 5 fig, 10 plates, 5 tab.

Descriptors: *Floods, *Flood profiles, *Channels, Flooding, Streamflow forecasting, Historic floods, Peak discharge, Flood peak, Flow duration, Channel improvement, *Missouri.
Identifiers: Portageville(MO), *Portage Open Bay(MO), Main Ditch(MO), Standard Project Flood, Intermediate Regional Flood.

Portage Open Bay, with a drainage area of approximately 50 square miles above the lower limits of this study, is part of the Little River drainage system. Main Ditch drains 18 sq mi and is a tributary of Portage Open Bay. The topography of this area is extremely flat and the average slope of Portage Open Bay is less than 1.5 feet per mile. The flood plain of Portage Open Bay is narrow and practically undeveloped below the mouth of Main Ditch, which has some development in its flood plain. It is likely that future extension of Portageville would be into the flood plain of Main Ditch. Major floods can occur in all seasons of the year and can rise from normal flow to peak in a relatively short period of time. There are no stream gages in the immediate study area, but the largest recent flood occurred in 1966 when some damage was caused in Portageville to buildings and roads. Other floods occurred in 1945 and 1957. In the event of an Intermediate Regional Flood peak discharges of 1310 cubic feet per second and 3060 cfs are expected in Main Ditch and Portage Open Bay respectively, along with water velocities up to 3 feet per second in the main channel and 1.6 ft/sec in the overbank area. This flood would rise to peak in 5.8 hours and last 92 hours above critical stage. Four of 7 bridges would be obstructive to flow. In a Standard Project Flood peak discharges of 2810 cfs and 6550 cfs are predicted for Main Ditch and Portage Open Bay respectively. Water velocities would be slightly higher than during the IRF. This flood would rise to peak in 36 hours and last 120 hours. All bridges would be obstructive to flow. (Smith-North Carolina)
W76-10156

FLOOD PLAIN INFORMATION: SOQUEL CREEK, SANTA CRUZ COUNTY, CALIFORNIA.
Army Engineer District, San Francisco, Calif.
Prepared for Santa Cruz County, July 1973. 20 p, 8 fig, 10 plates, 7 tab.

Descriptors: *Flood flow, *Flood profiles, *Flood data, *Flood stages, *Flood peak, *California, Runoff, Streamflow forecasting, Storms, Winds, Tides, Flood frequency, Peak discharge, Flow duration, Flow characteristics, Flood damage, Flood plains, Channels, Warning systems, Reservoirs, Obstructions to flow, Channel improvement.
Identifiers: Santa Cruz County(CA), Soquel Creek(CA), Soquel(CA), Capitola(CA), West Branch Soquel Creek(CA), Hester Creek(CA), Hinckley Creek(CA), Coast Range Mountains(CA), Intermediate Regional Flood, Standard Project Flood.

Soquel Creek originates in the Coast Range Mountains about 13 miles northeast of the City of Santa Cruz. West Branch Soquel, Hester Creek, and Hinckley Creek are major tributaries. The creek drains an area of 42 square miles, and flows through the towns of Soquel (population 5,795) and Capitola (population 5,080). Soquel Creek has a slope in its lower reaches of 20 ft/mi. There is commercial, agricultural, and residential development in the flood plain. Eleven floods have occurred since 1899, generally in the months of October to May. The bulk of flooding can be expected from December to March as the result of general winter storms. Obstructions to flood flows include vegetation and 5 bridges and culverts. The majority of the inundation along the lower reaches of Soquel Creek has been due to constrictive encroachment of buildings along the creek and the additional backwater effects caused by tides and winds. Heavy flooding occurred in December 1955 when a peak discharge at the gage in Soquel reached 15,800 cubic feet per second. Damage to commercial and residential development in Soquel was heavy. The Intermediate Regional Flood and the Standard Project Flood would have peak discharges of 16,400 and 19,800 cfs respectively. Channel velocities would range from 7-15 ft/sec and overbank velocities from 1-3 ft/sec during IRF. Soquel Creek would rise 13.7 feet in 6 hours and with flood stage lasting 22 hours. No flood control projects are authorized in this basin, but in 1955 channel clearing was carried out. (Henley-North Carolina)
W76-10157

FLOOD PLAIN INFORMATION: SOUTH FORK SALT RIVER AND DAVIS CREEK, MEXICO, MISSOURI.
Army Engineer District, St. Louis, Mo.
Prepared for the City of Mexico, Missouri, November 1971. 44 p, 11 fig, 15 plates, 13 tab.

Descriptors: Floods, Flooding, *Flood profiles, *Peak discharge, *Flood peak, *Flow duration, *Flood plains, Floodwater, Regional flood, Streamflow forecasting, River forecasting, Historic floods, Hydrographs, *Missouri.

Identifiers: *Salt River-South Fork(MO), Davis Creek(MO), Mexico(MO), Standard project Flood, Intermediate Regional Flood.

Much of the land of Mexico, MO, a town of 11,800 people, is located on high ground, yet there are substantial numbers of residences and commercial buildings in the flood plain. Davis Creek, with a drainage area of 53 square miles is a tributary of the South Fork Salt River which drains about 92 sq mi above the lower limit of the study area. No gages are maintained on either stream near Mexico. A gage near Santa Fe (MO) on the South Fork Salt River was used for this study. Most floods occur during the spring. The largest known flood occurred in 1969 with a peak discharge of 28,800 cubic feet per second recorded in Santa Fe. Damages and losses have been estimated in the thousands of dollars in past innundations. Damage from large future floods would range from substantial to disastrous proportions in areas where development is encroaching on the flood plain. In an Intermediate Regional Flood (IRF) a peak discharge of 20,000 cfs is predicted on Salt River and 12,580 cfs on Davis Creek. Water velocities of up to 5.2 ft/sec in the channel and 2.4 ft/sec in overbank areas are expected on Davis Creek; 4.3 ft/sec in the channel and 1.5 ft/sec overbank for South Fork Salt River. In a Standard Project Flood (SPF) peak discharges of 45,300 cfs and 28,000 cfs are anticipated on the Salt River and Davis Creek respectively. Velocities would be slightly higher than in the IRF which would rise to peak in 14 hours and last a maximum of 23 hours while the SPF would peak in 34 hours and last a maximum of 40 hours. Flash flood conditions could cause substantially higher rates of rise. Most bridges in the study area are somewhat obstructive to flood flow. There are no major flood control measures upstream or in the study area. (Smith-North Carolina)
W76-10158

FLOOD PLAIN INFORMATION: BIG SANDY RIVER, LAWRENCE COUNTY, KENTUCKY.
Army Engineer District, Huntington, W. Va.
Prepared for the State of Kentucky, Department of Natural Resources and Environmental Protection, October 1973. 30 p, 3 fig, 12 plates, 4 tab.

Descriptors: *Floods, *Flooding, *River flow, *Flood forecasting, *Flood profiles, *Flood plains, *Kentucky, Floodwater, Streamflow forecasting, Historic floods, Flow duration, Rivers, Reservoirs.
Identifiers: *Big Sandy River(KY), Tug Fork(KY), Levisa Fork(KY), Louisa(KY), Standard Project Flood, Intermediate Regional Flood.

Big Sandy River is formed by the confluence of Tug and Levisa Forks, and flows northward into the Ohio River. Big Sandy flows on an alluvial fill which contains few bottomlands above the flood of record. The Big Sandy drains 4,290 square miles. There is little development in the flood plains although there is some farming, a highway and a railroad. Louisa, the largest town, occupies high ground near the river. Eight of 10 major floods occurred in months January through April, though the largest flood, in 1875, occurred in July. Never have any floods damaged Louisa directly, yet during periods of high flow, roads, telephones, and water and sewerage systems are generally unusable. It is anticipated that as the area grows there will be pressure to develop bottom land causing heavy future damages. In the Levisa Fork basin 4 flood control reservoirs have been constructed which reduce flood crests by sizeable amounts. In an Intermediate Regional Flood floodwaters would be considerably higher than the largest flood of record, and about 10.7 feet higher than the major 1955 flood, with water velocities up to 8 feet per second. The IRF would rise to peak in about 42 hours and last 4 days. The Standard Project Flood, about 16.5 feet higher than the 1955 flood, would rise to peak in 47 hours and last 4.5 days. There are few obstructions to flow in these streams, though a recently constructed power plant could restrict flow of very large floods. There are no flood regulations in effect. However, Kentucky statutes require review of projects in floodways and the issuance of permits so that development can be controlled. (Smith-North Carolina)
W76-10159

SPECIAL FLOOD HAZARD INFORMATION: ARKANSAS RIVER, ARKANSAS CITY, KANSAS.
Army Engineer District, Tulsa, Okla.
Prepared for the City of Arkansas City, Kansas, January 1971. 6 p, 7 plates.

Descriptors: Floods, *Floodwater, Flooding, *Streamflow forecasting, *Flood profiles, *Flood plains, *Non-structural alternatives, Flood forecasting, Peak discharge, Stream erosion, Deposition(Sediments), Levee, *Kansas.
Identifiers: *Arkansas River(KS), Arkansas City(KS), Flood proofing.

Developments in this study area include considerable urban land in Arkansas City. In areas previously flooded are now built an oil refinery, a sewage disposal plant and many other structures. The Arkansas River is a tributary of the Mississippi River, and has a total length of about 1,460 miles and a drainage area of 160,600 square miles, 36,100 sq mi of which is above Arkansas City. 'The channel is generally wide and meandering, with low banks.' Though stream flow records are available from 1902 to 1906 and 1921 to the present, this data indicates that a stage-discharge relationship for the study reach would not be reliable because of the erosion and disposition of silt in the sandy channel of the river. The highest peak discharge, 103,000 cubic feet per second, occurred in 1923. Numerous times during the period 1902 to present the Arkansas River has exceeded its bank near Arkansas City. Flooding is most likely to occur from April to October. In an Intermediate Regional Flood a peak discharge of 120,000 cfs is estimated. Waters would reach a stage about 1.8 feet above the 1923 flood, and would overtop an existing levee and cause flooding within the levee. This report gives little information on existing protection measures, if any, but does give guidelines on possible solutions, including flood proofing, urban renewal, flood plain regulations, development policies, open space, tax adjustments and warning signs. (Smith-North Carolina)
W76-10160

SPECIAL FLOOD HAZARD INFORMATION: LABETTE AND LITTLE LABETTE CREEKS, PARSONS, KANSAS.
Army Engineer District, Tulsa, Okla.
Prepared for Labette County Planning Commission, Kansas, February 1973. 7 p, 1 fig, 13 plates, 1 tab.

Descriptors: *Floods, *Flood profiles, *Non-structural alternatives, *Flood plains, Flooding, Streamflow forecasting, Peak discharge, Flood plain zoning, Flood plain insurance, Warning systems, Building codes, Land use, *Kansas.
Identifiers: Labette Creek(KS), Little Labette Creek(KS), Parsons(KS), *Flood plain management, Intermediate Regional Flood.

The study area terrain consists of sparsely wooded, low rolling hills, and is used predominately for seasonal crops and pasture. Labette Creek, with a total drainage area of 397 square miles, is a tributary of the Neosho River. The drainage area above the lower limits of the study area is 88 sq mi. The flood plains of Labette Creek and Little Labette Creek are 1 mile and .5 mile wide respectively. 'The channel through the City of Parsons is well defined with fairly stable banks.' Though historical data indicates that Labette Creek has been subject to frequent flooding, this record is so sparse that it is not presented. In an Intermediate Regional Flood a peak discharge of 33,000 cubic feet per second on Labette Creek below Little Labette Creek is predicted. Above this confluence a peak discharge of 20,500 is expected. A peak discharge of 14,140 cfs is expected on Little Labette Creek. Several bridges in the study area would be overtopped by this flood. No flood plain management has been undertaken in this area, but this report gives guidelines, including a discussion of zoning, subdivision regulations, building codes, health regulations, development policies, and flood insurance. (Smith - North Carolina)
W76-10161

SPECIAL FLOOD HAZARD INFORMATION: WHISKEY AND ROCK CREEKS, INDEPENDENCE, KANSAS.
Army Engineer District, Tulsa, Okla.
Prepared for the City of Independence, Kansas, October 1974. 10 p, 5 plates, 1 tab.

Descriptors: *Floods, *Flood profiles, *Flood plains, *Flood protection, *Kansas, Flooding, Flood flow, Streamflow forecasting, Maximum probable flood, Peak discharge, Obstructions to flow, Non-structural alternatives, Flood plain zoning, Flood plain insurance, Building codes, Reservoirs.
Identifiers: Whiskey Creek(KS), Rock Creek(KS), Independence(KS), Standard Project Flood, Intermediate Regional Flood, Verdigris River(KS), Flood plain management.

Developments in the flood plains of this study area are mainly agricultural, residential and commercial. Whiskey Creek, with a watershed of 3.5 square miles, is a tributary of Rock Creek which in turn is a tributary of the Verdigris River near Independence. Rock Creek has a watershed of 24.8 sq mi including that of Whiskey Creek. No streamgage information is available for these creeks. For Rock Creek the maximum flood occurred in 1945, but caused little damage. In 1967 6.83 inches of rain in 20 hours caused the largest flood to date on Whiskey Creek. It was estimated to have a frequency of 50 years and had a peak discharge of 4,400 cubic feet per second. In an Intermediate Regional Flood (IRF) peak discharges of 5,000 cfs on Whiskey Creek at its confluence with Rock Creek, and 10,000 cfs on Rock Creek are expected. In a Standard Project Flood (SPF) discharges of 7,600 cfs and 19,400 cfs on Whiskey and Rock Creeks, respectively, are anticipated. In an IRF 2 of 8 bridges across Rock Creek would be obstructive to flood flow and in a SPF 5 bridges would cause some obstruction to flow. On Whiskey Creek all 17 bridges would obstruct flow in either major flood. Little has been done in this area to reduce flood damages, though 3 reservoir which have been built on the Verdigris River and its tributaries would reduce the backwater effects of that river. The report gives common methods for dealing with potential floods, including zoning, subdivision regulations, building codes, health regulations, development policies and flood insurance. (Smith - North Carolina)
W76-10162

FLOOD PLAIN INFORMATION: LYNN CAMP AND EAST FORK LYNN CAMP CREEKS, CORBIN, KENTUCKY.
Army Engineer District, Nashville, Tenn.
Prepared for the City of Corbin, Kentucky, May 1974. 42 p, 14 fig, 15 plates, 5 tab.

Descriptors: *Floods, Flooding, *Flood flow, *Flood profiles, *Historic floods, *Flood stages, Channel improvements, *Kentucky, Floodwater, Flash flood, Flood forecasting, Flood peak, Flow duration.
Identifiers: Corbin(KY), Lynn Camp Creek(KY), Standard Project Flood. Intermediate Regional Flood.

Most of the flood plain of Lynn Camp Creek in the only town in this study area, Corbin, is devoted to

residential, commercial and industrial uses. Lands in the upper ends of the study reach are largely undeveloped. On the East Fork Lynn Camp Creek there is only light residential build-up. The East Fork with a drainage area of 27.8 square miles flows into Lynn Camp Creek which has a drainage area of 61.2 sq mi. Major floods in this basin usually occur in late winter and early spring and are the result of prolonged heavy rain. Floods at Corbin can be of flash type, rising to crest very quickly. Stream gage data has been available in this area since 1957, shortly after the record flood in that year when peak discharge was about 9,000 cubic feet per second. Damage in Corbin was extensive and was estimated to be $2 million. In response to this flood the Corps of Engineers undertook a protection project which includes enlargement of about 2 miles of the natural channel, a cutoff channel about 475 feet long across an abrupt bend in the stream, and related bridge and drainage work. The project, completed in 1964, is capable of passing a flood 3 times the capacity of the original channel which will prevent most losses. It is estimated that because of this protection an Intermediate Regional Flood (IRF) would be 1.6 feet below the 1957 flood, though a Standard Project Flood (SPF) would be little curtailed by the project and would be 9.3 feet above the IRF. The IRF would be expected to rise to peak in 6 hours and last only 12 hours, while the SPF would rise in 7.5 hours and last 21 hours. (Smith - North Carolina)
W76-10163

FLOOD PLAIN INFORMATION: CLEAR CREEK-MULBERRY CREEK, VICINITY OF SHELBYVILLE, KENTUCKY.
Army Engineer District, Louisville, Ky.
Prepared for the City of Shelbyville and the Kentucky Department of Natural Resources, March 1973. 26 p, 17 fig, 8 plates, 6 tab.

Descriptors: Floods, *Flood flow, *Flood profiles, *Flood peak, *Flow duration, *Flood plains, Obstructions to flow, *Kentucky, Runoff, Floodwater, Flooding, Streamflow forecasting, Flood data.
Identifiers: Shelbyville(KY), Clear Creek(KY), Mulberry Creek(KY), Standard Project Flood, Intermediate Regional Flood.

Properties along Clear Creek are primarily rural in nature, though there are residential and commercial developments in Shelbyville, a town of 19,000 people, which includes many small industries, commerce, a fire department, a sewage treatment plant, sanitary land fill, and a lake park which is used for recreation. Mulberry Creek has little development along its banks. This creek, with a drainage of 8.4 square miles, flows into Clear Creek which has a total drainage area of 61.9 sq mi. Floods on these creeks are in general caused by runoff from intense rainfall in winter and spring months, though floods have occurred in all seasons. During the last 180 years Shelbyville and vicinity have been flooded many times. The 1964 flood was the largest when a peak discharge of 15,000 cubic feet per second was recorded on Clear Creek. Thirty people were forced to leave their homes and $500,000 in damages was caused. In an Intermediate Regional Flood (IRF) peak discharges of 17,700 cfs and 6,320 cfs are expected on Clear and Mulberry Creeks, respectively, along with water velocities up to 10 feet per second in the main channel and 3 ft/sec in the overbank areas. The IRF would reach peak elevation in about 12 hours after the beginning of rise and would be 20 hours above bankfull elevation. During a Standard Project Flood peak discharges of 28,400 cfs and 12,800 cfs are expected on Clear Creek and Mulberry Creek, respectively. Water velocities would be slightly higher than during the IRF. This flood would rise in 36 hours to 48 hours and remain 27 hours above bankfull elevation. (Smith - North Carolina)
W76-10164

FLOOD PLAIN INFORMATION: PIKE CREEK, NEW CASTLE COUNTY, DELAWARE.
Army Engineer District, Philadelphia, Pa.
Prepared for New Castle County (DE) Department of Planning, December 1975. 18 p, 3 fig, 9 plates, 7 tab.

Descriptors: *Floods, *Flooding, *Flood plains, *Peak discharge, *Non-structural alternatives, Flood stages, Flow characteristics, Flood protection, Flood plain zoning planning, *Delaware.
Identifiers: Pike Creek(DE), New Castle County(DE).

Pike Creek, a tributary to White Clay Creek, flows in a southeasterly direction for 6.4 miles through New Castle County covering a total drainage area of 6.3 square miles. Its flood plains consist of agricultural and rural areas with scattered residential and commercial properties which are coming under increasing pressure for development. Characterized by steep banks covered with brush and trees, the stream slopes at an average of 37 feet per mile in the southern reaches and 68 ft/mi in the northern portion. Floods generally occur in mid and late summer due to hurricane and thunderstorm activity reaching flood peaks in a relatively short period of time with high velocities. Although no flood control projects exist on Pike Creek, the county prohibits filling in or development of the flood plains. The greatest flood occurred in July 1969 having an estimated peak discharge of 2550 cubic feet per second and cresting at 40.1 feet. Estimated peak discharges and elevations for a 100-year and 500-year flood are 3,010 cfs and 5140 cfs cresting at 42.7 feet and 45.3 feet respectively. Projected velocities for 100-year flood range from 4.4 to 11.2 ft/sec in channel and from 2.8 to 4.0 ft/sec overbank; for a 500-year flood, 4.2 to 13.2 ft/sec in channel and 2.8 to 5.2 ft/sec overbank. A 100-year flood could have a critical stage for as long as 15 hours. This report furnishes a suitable basis for the adoption of land use controls to guide flood plain management. (Salzman - North Carolina)
W76-10165

FLOOD PLAIN INFORMATION: NORTH FORK KENTUCKY RIVER AND TRACE FORK, VICINITY OF HAZARD, KENTUCKY.
Army Engineer District, Louisville, Ky.
Prepared for the City of Hazard, Kentucky, March 1972. 44 p, 22 fig, 12 plates, 8 tab.

Descriptors: *Floods, *Flood forecasting, *Flood plains, Flooding, Flash flood, Overflow, Indirect flood measurement, Streamflow forecasting, Historic floods, Flood data, Peak discharge, Obstructions to flow, *Kentucky.
Identifiers: *Kentucky River(KY), Lotts Creek(KY), Trace Fork(KY), Hazard(KY), Intermediate Regional Flood, Standard Project Flood.

Development along the streams is principally located in Hazard though there are other communities and intermittent development elsewhere. A considerable number of structures are susceptible to flood damage. Trace Fork is a tributary of Lotts Creek which has a drainage area of 28 square miles and flows into the North Fork of the Kentucky River which drains 2,631 sq mi. In winter and spring floods are caused by widespread heavy rains, and in summer floods due to intense local thunderstorms occur. The largest flood was in 1957 when the peak discharge was 47,800 cubic feet per second, and the business district of Hazard was completely destroyed. Damages were estimated at $6.8 million. Water velocities reached 7 feet per second. In an Intermediate Regional Flood (IRF) a peak discharge of 52,300 cfs is predicted on the North Fork Kentucky River and 2,580 on Trace Fork. Water velocities may range up to 14 and 18 ft/sec in the main channel of North Fork Kentucky River and Trace Fork respectively. Overbank velocities would be 4.6 and 8.5 ft/sec respectively. In a Standard Project Flood (SPF) peak discharges of 140,000 and 5,340 cfs are anticipated on North Fork Kentucky River and Trace Fork respectively along with water velocities slightly higher than the IRF. Most of the many bridges over these streams would be at least somewhat obstructive to flows and some would be very obstructive. Now under construction is a dam at Carr Fork Lake which will have some impact on floods in this study area. Peak discharges would be reduced to 50,300 cfs in an IRF and 135,000 cfs in a SPF. (Smith-North Carolina)
W76-10166

FLOOD PLAIN INFORMATION: DRY TURKEY AND BULL CREEKS, MCPHERSON, KANSAS.
Army Engineer District, Tulsa, Okla.
Prepared for the City of McPherson, Kansas, August, 1972. 31 p, 8 fig, 17 plates, 5 tab.

Descriptors: Floods, *Flood flow, *Flood profiles, *Flow duration, *Flood plains, *Non-structural alternatives, Floodwater, Streamflow forecasting, Historic floods, Peak discharge, Obstructions to flow, Flood plain zoning, *Kansas.
Identifiers: Dry Turkey Creek(KS), Bull Creek(KS), McPherson(KS), Subdivision regulations, Standard Project Flood, Intermediate Regional Flood.

Much of the land in the flood plains along these streams is agricultural, except in McPherson, (population 11,000) an important oil producing area, which is expected to grow in the future. Bull Creek, with a drainage area of 19.6 square miles, is a tributary of Dry Turkey Creek which drains 55.5 sq mi and flows into Turkey Creek. Flooding results generally from intense storms of short duration, occuring usually in spring and fall. Due to mild stream slopes and relatively flat overbank areas, flood waters rise slowly, cover considerable land, and last for extended periods. There are no stream-gages in the area, but six major floods have occurred since 1902. In an Intermediate Regional Flood peak discharges of 5,400 cubic feet per second and 13,900 cfs can be expected on Bull and Dry Turkey Creeks, respectively, along with water velocities of about 2 ft/sec in the main channel and overbank areas. In a Standard Project Flood peak discharges of up to 10,800 cfs on Bull Creek and 27,000 cfs on Dry Turkey Creek are predicted. Water surface elevations for the SPF are estimated to reach as much as 5 feet in some sections of McPherson. Major floods last approximately 30 hours. Most bridges on Dry Turkey Creek and all bridges on Bull Creek would be topped by either flood. There are no existing or proposed Federal flood control measures on these Creeks, though some channel improvements have been constructed by local interests. Subdivision regulations restrain building on lands subject to periodic flooding, yet with proper improvements and adequate drainage such construction can be undertaken. (Smith-North Carolina)
W76-10167

TECHNIQUES FOR IMPROVING TREE SURVIVAL AND GROWTH IN SEMIARID AREAS,
Agricultural Research Service, Manhattan, Kans.
For primary bibliographic entry see Field 2I.
W76-10175

OBSTACLES TO THE DEVELOPMENT OF ARID AND SEMI-ARID ZONES.
For primary bibliographic entry see Field 3F.
W76-10179

COMPARISON OF SHEEP AND CATTLE GRAZING ON SEMIARID GRASSLAND,
Commonwealth Scientific and Industrial Research Organization, Deniliquin (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 4C.
W76-10181

ARIZONA'S WATER SUPPLY-SOME REFLECTIONS,
Arizona Bureau of Mines, Tucson.
H. W. Peirce.
Field Notes, Vol. 6, No. 2, p 1-4, 16, June 1976. 2 fig, 2 ref.

Descriptors: *Arizona, *Water resources development, *Water supply, *Water utilization, *Basins, Water management(Applied), Arid lands, Range management, Human population, Natural resources, Withdrawal, Long-term planning, Agriculture, Groundwater, Geologic formations.

Arizona's water supply and use characteristics are analyzed, and an approach to effective management of this limited resource is outlined. At present, substantially more water is being used than is replenished by natural sources, especially in the areas of rapid population growth (Phoenix and Tucson). This Basin and Range region of southwestern Arizona has more natural resources such as water, minerals and better climate and soil conditions for attracting new residents. The Plateau region in northern Arizona is superior only in its quantity of fossil energy sources. Currently, surface waters account for 40% and pumped underground water for 60% of the withdrawals; 89% of the water is used for agriculture. Over 2 million acre-feet more water is used annually than is replenished. Depletion rates are nearly 100 times the magnitude of dependable (renewable) supply in some of the smaller hydrologic basins. Other statistics relating to water use are provided along with a description of the Basin and Range Province development. (Jahns-Arizona)
W76-10183

INTERACTION OF WATER POTENTIAL AND TEMPERATURE EFFECTS ON GERMINATION OF THREE SEMI-ARID PLANT SPECIES,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2I.
W76-10185

AN LP-10 MODEL FOR COORDINATING MULTI-GROUP INPUTS IN RESOURCE PLANNING,
Hawaii Univ., Honolulu.
For primary bibliographic entry see Field 6A.
W76-10192

URBAN SERVICE PRICING AND LAND USE: SOME PRELIMINARY RESULTS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 6C.
W76-10193

NETWORK MODELS AND THE IMPACT OF MODELING ASSUMPTIONS,
Alyeska Pipeline Service Co., Anchorage, Alaska.
C. L. Eggener, and L. B. Polkowski.
Journal of the American Water Works Association, Vol. 68, No. 4, p 189-196, April 1976. 3 fig, 9 tab, 12 ref.

Descriptors: *Networks, *Water distribution(Applied), *Mathematical models, *Simulation analysis, Research, Digital computers, History, Pipes, Water demand, Hazen-Williams equation, Systems analysis, Wisconsin.
Identifiers: Impact, Menomonie(Wis).

With increased emphasis on digital computer modeling of the hydraulic performance of water distribution networks for design and automatic operational control, there has been a recent upsurge of interest in the impact of expedients commonly employed in network simulation, i.e., skeletonization, load consolidation, C value allocation, and assumed pipe resistance factors). This article presents an historical explanation of the recent upsurge of interest and presents an approach to studying the impact of simulation expedients; it is an approach to fulfilling the research need, consisting of building detailed models of actual but representative grid systems, verifying the performance of the models, and using them as research tools to investigate the impact of various simplifying assumptions often made in network modeling. The value of the approach is demonstrated with a case study made in Menomonie, Wisconsin, and its merits are discussed in terms of ultimately being able to generalize about the degree of input data refinement necessary to model grid systems adequately. (Bell-Cornell)
W76-10196

THE INFLUENCE OF THE SURFACE RUNOFF OF HEAVY RAINS ON THE CALCULATION OF SEWERS (UBER DEN EINFLUSS DES FLACHENABFLUSSES DER STARKREGEN AUF DIE BERECHUNG VON KANALISATIONEN),
For primary bibliographic entry see Field 5D.
W76-10197

THE EFFECT OF VARIOUS DESIGNS OF RAIN CATCHING BASINS ON THE POLLUTION OF THE RECEIVING WATER AND THE ECONOMY OF THE SEWER SYSTEM (DIE AUSWIRKUNG DER VERSCHIEDENEN BAUARTEN VON REGENUBERLAUFBECKEN AUF DIE SCHMUTZBELASTUNG DES VORFLUTERS UND DIE WIRTSCHAFTLICHKEIT DES KANALNETZES),
Stuttgart Univ. (West Germany). Institut fuer Siedlungswasserbau und Wasserguetewirtschaft.
For primary bibliographic entry see Field 5D.
W76-10198

MINIMIZATION OF CORE REQUIRED IN ROUTING THROUGH A CHANNEL NEWTWORK,
Hydrocomp International, Palo Alto, Calif.
For primary bibliographic entry see Field 2E.
W76-10243

STRENGTHENING LAKE-SHORELAND MANAGEMENT IN MASSACHUSETTS,
Massachusetts Univ., Amherst, Water Resources Research Center.
For primary bibliographic entry see Field 6E.
W76-10264

A PRELIMINARY COMPARTMENT MODEL OF THE NITROGEN CYCLE IN A DECIDUOUS FOREST ECOSYSTEM,
Idaho Univ., Moscow. College of Forestry, Wildlife and Range Sciences.
For primary bibliographic entry see Field 5B.
W76-10269

A MODEL OF WATER CONTENT AND EVAPORATION FOR HARDWOOD LEAF LITTER,
Western Carolina Univ., Cullowhee, N.C. Dept. of Biology.
For primary bibliographic entry see Field 2D.
W76-10270

SIMULATION OF NITROGEN DISTRIBUTION AND ITS EFFECT ON PRODUCTIVITY IN EVEN-AGED LOBLOLLY PINE PLANTATIONS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Theoretical Production Ecology.
For primary bibliographic entry see Field 5B.
W76-10271

A MODEL OF MINERAL-ELEMENT CYCLING FOR AN INVERTEBRATE FOOD WEB IN A SOUTHEASTERN HARDWOOD FOREST LITTER COMMUNITY,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 5C.
W76-10272

SEASONAL AND ANNUAL VARIATIONS IN THE QUANTITIES OF NITROGEN, POTASSIUM, PHOSPHORUS, MAGNESIUM, CALCIUM, AND MANGANESE REACHING THE FOREST FLOOR AS MAST IN PENNSYLVANIA AND VERMONT FORESTS,
Massachusetts Univ., Amherst. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W76-10306

RESOURCE PARTITIONING IN LEAF-LITTER FAUNAS FROM HARDWOOD AND HARDWOOD-CONVERTED-TO-PINE FORESTS,
Battelle-Columbus Labs., Ohio. Ecology and Ecosystems Analysis Section.
For primary bibliographic entry see Field 5B.
W76-10308

FOREST-FLOOR NUTRIENT DYNAMICS IN SOUTHERN APPALACHIAN HARDWOOD AND WHITE PINE PLANTATION ECOSYSTEMS,
Environmental Protection Agency, Washington, D. C. Office of Environmental Sciences.
For primary bibliographic entry see Field 5B.
W76-10309

LEACHING OF NUTRIENTS FROM LEAVES OF SELECTED TREE SPECIES IN NEW HAMPSHIRE,
New Mexico Univ., Albuquerque. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W76-10312

PHOSPHORUS CYCLING IN A MARYLAND DECIDUOUS FOREST SUBJECTED TO VARIOUS LEVELS OF MINERAL-NUTRIENT LOADING,
Smithsonian Institution, Rockville, Md. Radiation Biology Lab.
For primary bibliographic entry see Field 5B.
W76-10313

ASPECTS OF MINERAL-NUTRIENT CYCLING IN A SOUTHERN MIXED-HARDWOOD FOREST IN NORTH CENTRAL FLORIDA,
Florida Univ., Gainesville. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W76-10318

THE QUANTITY AND DISTRIBUTION OF FOUR NUTRIENT ELEMENTS IN HIGH-ELEVATION FOREST ECOSYSTEMS, BALSAM MOUNTAINS, NORTH CAROLINA,
Southern Illinois Univ., Carbondale, Dept. of Forestry.
For primary bibliographic entry see Field 5B.
W76-10319

SIGNIFICANCE OF BIOLOGICAL NITROGEN FIXATION AND DENITRIFICATION IN A DECIDUOUS FOREST ECOSYSTEM,
Georgia Univ., Athens. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W76-10320

SOME EFFECTS OF FERTILIZATION ON MINERAL CYCLING IN LOBLOLLY PINE,
Southeastern Forest Experiment Station, Research Triangle Park, N.C. Forestry Sciences Lab.
For primary bibliographic entry see Field 5C.

W76-10323

COMBINED USE OF PHYSICAL AND MATHEMATICAL MODELS FOR ANALYSIS OF RESERVOIR WATER QUALITY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
For primary bibliographic entry see Field 5B.
W76-10439

FLOW2D: A TWO-DIMENSIONAL FLOW MODEL FOR FLOOD PLAINS AND ESTUARIES,
Resource Analysis, Inc., Cambridge, Mass.
For primary bibliographic entry see Field 2L.
W76-10454

ALGAE HARVESTER,
For primary bibliographic entry see Field 5G.
W76-10478

4B. Groundwater Management

PREDICTING THE WATER POLLUTION POTENTIAL OF PROPOSED SANITARY LANDFILLS PART I: SANITARY LANDFILL LEACHATE...WHAT IT IS,
Indiana Univ., Indianapolis. School of Medicine.
For primary bibliographic entry see Field 5B.
W76-10013

PREDICTING THE WATER POLLUTION POTENTIAL OF PROPOSED SANITARY LANDFILLS PART II: AN INDEX OF THE WATER POLLUTION POTENTIAL OF SANITARY LANDFILLS,
Indiana Univ., Indianapolis. School of Medicine.
For primary bibliographic entry see Field 5B.
W76-10014

POLLUTION OF GROUNDWATER BY LANDFILLS (POLLUTION DE L'EAU SOUTERRAINE PAR LES DECHARGES),
For primary bibliographic entry see Field 5B.
W76-10016

GROUND-WATER POLLUTION PROBLEMS IN THE NORTHWESTERN UNITED STATES,
Robert S. Kerr Environmental Research Lab., Ada, Okla.
For primary bibliographic entry see Field 5B.
W76-10083

HYDROGEOLOGIC AND OTHER CONSIDERATIONS RELATED TO THE SELECTION OF SANITARY-LANDFILL SITES IN OHIO,
Ohio Dept. of Natural Resources, Columbus. Regional Geology Section.
For primary bibliographic entry see Field 5D.
W76-10084

INTERNATIONAL SURVEY ON EXISTING WATER RECHARGE FACILITIES.
International Association of Scientific Hydrology, Gentbrugge (Belgium).
Publication No. 87, 1970. 761 p, 32 fig. $10.00.

Descriptors: *Artificial recharge, *Water management(Applied), *Groundwater recharge, Natural recharge, Water wells, Recharge wells, Aquifers, Overdraft, Well yield, Safe yield, Flooding, Water level fluctuations, Watersheds(Basins), Groundwater barriers, Geologic control, Geohydrologic units.
Identifiers: *International artificial recharge installation survey.

The International Association of Scientific Hydrology with the assistance of the Burgeap Company (France) established an international inventory of installations for the artificial recharge of underground water-levels. The aims pursued are solutions to the problems of: (1) Dry season pumping at higher rates than natural aquifer recharge capacities; (2) Water storage allowing pumping rates greatly superior to natural groundwater resources; (3) Recharge of overpumped ground-water reservoirs', (4) Improvement of water quality by natural filtration, (5) Fresh water barriers against saline intrusion or infiltrations from polluted rivers; and (6) Flood control. The economics of artificial recharge as well as the reasons for choosing it over alternative measures. Each country included in the recharge installation inventory conducts the process in various geologic lithologies ranging from Diluvium gravels to basalts. This wide variety of lithologies effectively represents worldwide geohydrologic conditions. The origin of injected water, techniques of recharge, structures used for artificial recharge and pumping systems are outlined for each particular installation listed. The inventoried countries include: Germany (western), Australia, England, France, Hungary, Iran, Israel, Jamaica, Japan, Morracco, Mexico, Holland, South Africa, Switzerland, Czechoslovakia and the United States of America. (Heiss-NWWA)
W76-10085

FIELD RESEARCH AND TESTING OF A WATER HAND PUMP FOR USE IN DEVELOPING COUNTRIES,
Battelle Columbus Lab., Ohio.
For primary bibliographic entry see Field 8G.
W76-10086

CHANGE IN DRAWDOWN CAUSED BY ENLARGING A WELL IN A DOLOMITE AQUIFER,
Geological Survey, Columbus, Ohio. Water Resources Div.
S. E. Norris.
Ground Water, Vol. 14, No. 4, p 191-193, July-August, 1976. 1 fig, 2 tab, 5 ref.

Descriptors: *Water wells, *Drilling, *Drawdown, Aquifers, Permeability, Turbulent flow, Groundwater, Ohio.
Identifiers: *Well modification, *Well enlargement, Well-loss constant, Pumping rates, Power cost reduction.

Step-drawdown tests were conducted on a well, in a dolomite aquifer in north-central Ohio, before and after it was enlarged from 10 inches to 12 inches (250 to 300 millimeters) in diameter. Changes were noted in the well-loss constant, the exponent for turbulent flow and the formation loss factor. The calculated difference in drawdown resulting from enlargement is of little importance at rates of 300 to 500 gallons per minute (19 to 31 liters per second), the range of which the well is expected to be pumped, but for higher rates the decrease in drawdown and consequent reduction in power costs could be significant. For a pumping rate of 1500 gallons per minute (95 liters per second), the decrease in drawdown would be 20.4 (6.2 meters). (Heiss-NWWA)
W76-10088

TACOMA'S NORTH FORK WELLS.
Ground Water Age, Vol. 10, No. 10, p 26-28, 43, June, 1976.

Descriptors: *Water wells, *Groundwater, *Surface-ground water relationships, Unconfined aquifers, Sands, Gravels, Pumps, Rotary drilling, Well screens, Water requirements, Water resources development, Water supply, Washington.
Identifiers: *High volume water wells, *High volume submersible pumps, *Green River(Wash), *North Fork(Wash), Tacoma(Wash).

Seven of the most productive water wells in the world are currently being constructed on the North Fork of Washington's Green River. These wells are a part of a 55-million dollar project intended ultimately to double the City of Tacoma's water supply. Each well will yield an estimated twelve-million gallons of water per day. The preliminary ground-water feasibility study performed by Tacoma ground-water geologists showed that a sand and gravel body which underlies, and is fed directly by the North Fork of the Green River near the confluence of the two streams. The study indicated that the aquifer's specific yield was in excess of 72-million gallons per day. The wells were designed for thirty-two inch casings containing twenty-eight inch inner diameter stainless steel screens. Submersible pumps equipped with 380 horsepower, 2300 volt meters, eleven feet long and seventeen inches in diameter were used in the wells, each capable of producing an average of 8,333 gallons per minute. These wells will fulfill Tacoma's water need well into the 21st century. (Heiss-NWWA)
W76-10089

ELECTRICAL WATER PROSPECTING.
Ground water Age, Vol. 10, No. 9, p 27, 30, May, 1976. 1 fig.

Descriptors: *Subsurface investigations, *Electrical resistivity, *Logging(Recording), *Subsurface mapping, *Water wells, Physical properties, Geologic formations, Arid lands, Foreign countries, Africa.
Identifiers: *Geo-electric soundings, Apparent resistivity, Electrode fields, Electrical potential variations, *Geo-electric models, Bore siting, South West Africa.

Geo-electrical soundings have been used for the past two years to find water in the arid northern region of South West Africa. The work is directed at improving the siting of useful boreholes, which previously has had a success rate of only approximately 30 percent in this area. To date, one well has been sunk using geo-electrical soundings, and water was found at an encouragingly shallow depth. The geo-electrical technique is based on the different electrical resistivities of geologic formations. The apparent resistivity of the area is found by passing a current through the ground between electrodes and measuring the resulting potential difference between the furthest pair. Expansion and rearrangement of the electrode field about a chosen point registers the variation of apparent resistivity. This variation of the apparent resistivity with electrode separation can be depicted as a sounding curve. Interpretation of this curve makes it possible to construct a geo-electrical model of the geological structure of the subsurface. The position of the water table profoundly affects the readings. If this application can be verified most of the guess work can be taken out of borehole siting in the area. (Heiss-NWWA)
W76-10090

RECORDING EQUIPMENT BOOSTER.
For primary bibliographic entry see Field 8G.
W76-10091

PITLESS UNIT AND ADAPTER UPDATE.
For primary bibliographic entry see Field 8G.
W76-10092

WHAT TYPE OF RIG SHOULD YOU BUY,
For primary bibliographic entry see Field 8C.
W76-10094

CORROSION,
Plummer and McDannald Co., Galena, Ohio.
For primary bibliographic entry see Field 8G.
W76-10095

GUARDIANS OF GROUND WATER QUALITY,
National Water Well Association, Worthington, Ohio.
For primary bibliographic entry see Field 5G.
W76-10096

EXXON USES HANDS-ON METHODS TO TRAIN DRILLING PERSONNEL,
Exxon Co., New Orleans, La.
For primary bibliographic entry see Field 8G.
W76-10098

SELECTING PACKER FLUIDS: HERE'S WHAT TO CONSIDER,
Delta Mud and Chemical Co., Houma, La.
For primary bibliographic entry see Field 8G.
W76-10099

PREDICTING PRODUCTIVE TRENDS RELATED TO WRENCH FAULTS,
Exxon Production Research Co., Houston, Tex.
For primary bibliographic entry see Field 8E.
W76-10100

FRESH WATER CAN BE STORED IN SALINE AQUIFERS,
Louisiana State Univ., Baton Rouge.
O. K. Kimble, R. G. Kazmann, and W. R. Whitehead.
The Johnson Drillers Journal, Vol. 48, No. 2, p 1-4, 17-18, March-April, 1976. 3 fig.

Descriptors: *Aquifers, *Underground storage, *Reservoirs, *Saline water, Freshwater, *Saline water-fresh water interfaces, Injection wells, Water wells, *Storage capacity, Withdrawal, Pumped storage, Reservoir silting, Saline water intrusion, *Water storage.
Identifiers: *Saline aquifers, Injection-withdrawal cycles, Recovery efficiency, Emergency reservoirs, Surface reservoir disadvantages.

Due to the growing need for emergency fresh water reservoirs, the concept of storing fresh water in saline aquifers is being considered. Traditionally the dammed surface reservoir has served the purpose; but now because of land costs and realization of the silt problems, surface reservoirs have become much less advantageous. Deep saline aquifers underlay much of the country and offer potential storage space for fresh water in convenient locations. Essentially the process is achieved by creating a stagnant zone in the ground water flow of a selected aquifer and storing fresh water in that zone. Fresh water and salt water is segregated due to their density differences. The resultant body of fresh water will be shaped like an inverted, truncated cone whose outer volume is composed of a brackish water interface and whose inner volume is made up of fresh water. The injection field can be single or multi well systems. Recovery efficiency increases after the second injection/withdrawal cycle. The length of storage without appreciable harm to the recovery ratio cannot be predicted at this point. Further study is required in this area before projects of this nature can be implemented. (Heiss-NWWA)
W76-10107

EFFECTS OF A LANDFILL ON GROUNDWATER QUALITY,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 5B.
W76-10137

DIGITAL MODEL FOR SIMULATED EFFECTS OF GROUND-WATER PUMPING IN THE HUECO BOLSON, EL PASO AREA, TEXAS, NEW MEXICO, AND MEXICO,
Geological Survey, Austin, Tex.
W. R. Meyer.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-253 015 as printed copy $5.50, microfiche $2.25. Water-Resources Investigations 58-75, April 1976. 31 p, 13 fig, 2 tab, 12 ref.

Descriptors: *Groundwater resources, *Model studies, *Water levels, *Projections, *Pumping, *Computer programs, Analytical techniques, Hydrogeology, Aquifer characteristics, Water table, Groundwater recharge, Water storage, *Texas.
Identifiers: *Hueco Bolson(Tex), *El Paso area(Tex).

The Hueco Bolson provides a substantial part of the municipal and industrial water supply of the El Paso area of Texas, New Mexico, and Mexico. Although the supply of fresh groundwater in the bolson is large, about 10.6 million acre-ft (13,070 cubic hectometres) in 1973 in the Texas part of the bolson alone, the supply is being depleted. A digital model study showed that a proposed plan of development for 1973-91. in which pumping would be increased by 29 percent in the Texas part of the bolson and by 34 percent in Ciudad Juarez, would cause additional water-level declines of as much as 45 feet (13.7 m) in the vicinity of El Paso and 70 feet (21.3 m) in Ciudad Juarez. The study also showed that nearly 60 percent of the water would come from storage in the water-table part of the bolson aquifer and 28 percent from leakage from the alluvium. By the end of the period, 9.84 million acre-ft (12,133 cubic hectometres) of fresh water would be in storage in the Texas part of the bolson, as compared to 10.6 million acre-ft (13,070 cubic hectometres) in storage in 1973. (Woodard-USGS)
W76-10140

NATIONAL WATER DATA STORAGE AND RETRIEVAL SYSTEM: INSTRUCTIONS FOR PREPARATION AND SUBMISSION OF GROUND-WATER DATA,
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 10D.
W76-10148

MAPS SHOWING GROUND-WATER CONDITIONS IN THE RANEGRAS PLAIN AND BUTLER VALLEY AREAS, YUMA COUNTY, ARIZONA--1975,
Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 7C.
W76-10149

ARIZONA'S WATER SUPPLY-SOME REFLECTIONS,
Arizona Bureau of Mines, Tucson.
For primary bibliographic entry see Field 4A.
W76-10183

COST FUNCTIONS FOR ADDITIONAL GROUND WATER DEVELOPMENT,
Geological Survey, Reston, Va. Water Resources Div.
T. Maddock, III.
Water Resources Bulletin, Vol. 12, No. 3, p 539-545, June 1976. 2 tab, 9 equ, 6 ref.

Descriptors: *Groundwater, *Water resources development, *Water rights, Costs, Energy, Industries, Equations, Operating costs.
Identifiers: *Cost functions, *Coal gasification.

In many regions of the United States, the development of new water-intensive industries for production of energy may upset the existing water rights structure. Such an industry is coal gasification. This paper develops external cost functions for determining compensation to existing groundwater users when additional withdrawals are requested by new users. The functions reflect increased energy costs, and as presented, they are based on a linear relation between drawdown and pumping. It is assumed that the fixed cost of drilling and completing wells and the variable cost of operating wells overshadow the pipeline company's compensatory payments. It is also assumed that the energy costs represent the profit losses to the original users. In conclusion, it should be noted that compensation payment will result in costs to new users that are not trivial. (Bell-Cornell)
W76-10194

USE OF THE EARTH'S CRUST FOR TREATMENT OR STORAGE OF SEWAGE EFFLUENT AND OTHER WASTE FLUIDS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 5D.
W76-10216

THE FATE OF POLLUTANTS IN SUBSURFACE ENVIRONMENTS,
Weston (Roy F.), Inc., West Chester, Pa.
For primary bibliographic entry see Field 5B.
W76-10253

PROGRAM ESOPH - EXTENDED SOPH, SIMULATION OF TIME-VARIANT PIEZOMETRIC SURFACE IN A CONFINED, LEAKY AQUIFER SUBJECTED TO PUMPING.
Department of the Environment, Ottawa (Canada). Inland Waters Directorate.
For primary bibliographic entry see Field 7C.
W76-10498

4C. Effects On Water Of Man's Non-Water Activities

HIGHWAY-WILDLIFE RELATIONSHIPS VOLUME 1. A STATE-OF-THE-ART REPORT,
Urban Wildlife Research Center, Inc., Ellicott City, Md.
D. L. Leedy.
Report FHWA-RD-76-4, December 1975, 183 p. Final report to Department of Transportation, Washington, D.C., Federal Highway Administration. FCP 33F2-182 P. O. 5-30189.

Descriptors: *Highway effects, Highways, *Wildlife, Fish, *Reviews, Erosion, *Erosion control, *Bibliographies, Research priorities, *Environmental effects, Comprehensive planning, *Vegetation establishment, *Right-of-way, Wildlife habitats, Wildlife management, *Highway deicing, Parks, Waste disposal, Pollution abatement, Fish passages, *Road construction, Roads, Transportation.

This study assesses, primarily through an extensive literature review, what is known about highway-wildlife relationships and suggests research and management approaches to protect and enhance fish, wildlife, and environmental quality. A cooperative effort to this end among natural resource and highway agency personnel is needed on a continuing basis from the initial planning stages for new highway construction through operation and maintenance. The 20 million or more acres in highway rights-of-way have been largely neglected as wildlife habitat. Opportunities exist for creating valuable fish and wildlife impoundments during construction, yet the minimal effort needed to locate and design such impoundments has generally not been made. The Nation's four million miles of streets and highway often create 'edges' conducive to wildlife. Many millions of wild vertebrates are killed annually, but apparently most wildlife populations are not seriously affected by such losses. Highway construction through limited ranges of endangered species can be a serious problem, as can erosion, wetland drainage, stream alteration, structures which

block the passage of anadromous fish, and pollutants resulting from highway maintenance and use. Better measures for mitigating habitat losses, predicting effects of highways on fish and wildlife, reducing animal-vehicle accidents, and enhancing highway environment for fish, wildlife, and people are sorely needed. (See also W76-10004) (FHA)
W76-10003

HIGHWAY-WILDLIFE RELATIONSHIPS VOLUME 2. AN ANNOTATED BIBLIOGRAPHY,
Urban Wildlife Research Center, Inc., Ellicott City, Md.
D. L. Leedy, T. M. Franklin, and E. C. Hekimian.
Report FHWA-RD-76-5, December 1975, 417 p. Final report to Department of Transportation, Washington, D.C., Federal Highway Administration. FCP 33F2-182 P.O. 5-3-0189

Descriptors: *Highway effects, Highways, *Wildlife, Fish, *Reviews, Erosion, *Erosion control, *Bibliographies, Research priorities, *Environmental effects, Comprehensive planning, *Vegetation establishment, *Right-of-way, Wildlife habitats, Wildlife management, *Highway deicing, Parks, Waste disposal, Pollution abatement, Fish passages, *Road construction, Roads, Transportation.

This annotated bibliography of 794 references is based as much as possible upon examination of original articles, particularly from the wildlife literature. The following major subject matter headings are included: The Highway System: Effects on and Relation to Fish and Wildlife; Opportunities for Enhancing Fish and Wildlife and Mitigating or Reducing Damage to the Resource; and Environmental Considerations and Evaluations in Highway Planning, Construction and Operation - General. (See also W76-10003) (FHA)
W76-10004

EFFECTS OF LARGE SCALE FOREST FIRES ON WATER QUALITY IN INTERIOR ALASKA,
National Environmental Research Center, College, Alaska. Arctic Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W76-10045

CHEMICAL IMPACT OF SNOW DUMPING PRACTICES,
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5C.
W76-10049

AN ENVIRONMENTAL ASSESSMENT OF IMPACTS OF COAL DEVELOPMENT ON THE WATER SOURCES OF THE YAMPA RIVER BASIN, COLORADO AND WYOMING--PHASE-1 WORK PLAN,
Geological Survey, Denver, Colo.
T. D. Steele, D. P. Bauer, D. A. Wentz, and J. W. Warner.
Open-file report 76-367, May 1976. 17 p, 2 fig, 3 tab, 11 ref.

Descriptors: *Water quality control, *Water pollution sources, *Coal mine wastes, *Energy conversion, *Environmental effects, Project planning, Water rights, Water demand, Land use, Data collection, River basin development, Colorado, Wyoming.
Identifiers: *Yampa River basin(Colo-Wyo).

Coal resources of the western United States are being developed at ever-increasing rates, causing concerns of the effects of mining and associated activities on the environment. The Yampa River basin in northwestern Colorado and south-central Wyoming is undergoing economic development of its coal, oil and gas, and uranium resources. The Yampa River basin assessment is a 2.5-year program of the U.S. Geological Survey. It is designed primarily to assess the availability and quality of the basin's water resources. The basin assessment also will evaluate potential environmental and selected socioeconomic impacts of energy-resource development plans proposed by mining and power companies. This report serves as a project work plan for the basin assessment's first-phase work activities. (Woodard-USGS)
W76-10135

COMPARISON OF SHEEP AND CATTLE GRAZING ON SEMIARID GRASSLAND,
Commonwealth Scientific and Industrial Research Organization, Deniliquin (Australia). Div. of Land Resources Management.
A. D. Wilson.
Australian Journal of Agricultural Research, Vol. 27, No. 1, p 155-162, January, 1976. 2 tab, 2 fig, 12 ref.

Descriptors: *Sheep, *Cattle, *Grazing, *Pasture management, *Grasslands, Arid lands, *Australia, Diets, Grasses, Seasonal, Legumes, Forage palatability.
Identifiers: *New South Wales.

A 2-year study in New South Wales compared Hereford steers and Border Leicester X Merino wethers as to their diet's botanical and chemical composition and changes in body weight while grazing a semiarid grassland in adjacent paddocks. The Danthonia caespitosa-Stipa variabilis type grassland contained 200-800 kg/ha of green pasture, primarily warm-season grasses with components of cool-season grasses, chenopod plants, medics and other forbs. Plots were permanently grazed by sheep at 1.03 and 1.45/ha or cattle at 0.13 and 0.18/ha; animals fitted with esophageal fistulas were introduced periodically to estimate diet composition. Cattle ate fewer short medics and cool-season grasses and more dry herbage than sheep, although in vitro digestibles of both diets were similar. Cattle diets were consistently lower in nitrogen and had a higher weight/ha at the greater stocking rate. Weight fluctuations at both stocking rates were greater for sheep, although the differences were slight. Similar weight changes did not support the notion that sheep are better suited to semiarid winter-rainfall areas. Economic differences will probably be more important than biological ones in determining the ratio of sheep to cattle on grazing properties. (Jahns-Arizona)
W76-10181

MICROBIOLOGY AND CHEMISTRY STUDIES OF WATER QUALITY FACTORS IN A WATERSHED USED FOR MUNICIPAL SUPPLY AND WASTE DISPOSAL,
Montana State Univ., Bozeman. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 5B.
W76-10263

EFFECTS OF CLEAR-CUTTING ON NUTRIENT LOSSES IN ASPEN FORESTS ON THREE SOIL TYPES IN MICHIGAN,
Michigan Univ., Ann Arbor. School of Natural Resources.
C. J. Richardson, and J. A. Lund.
In: 'Mineral Cycling in Southeastern Ecosystems, 1975, (CONF-740513), p 673-686. 1 fig, 3 tab, 27 ref.

Descriptors: *Clear-cutting, *Nutrients, *Deciduous forests, *Soil types, *Leaching, Michigan, Nutrient cycling, Absorption, Nitrates, Ammonia, Phosphates, Potassium, Calcium, Sodium, Iron, Magnesium, Precipitation(Atmospheric), Groundwater, Hydrologic budget.
Identifiers: Aspen forests.

Clear-cutting of aspen may not significantly reduce nutrient uptake because of rapid revegetation by aspen root sprouts. Rapid shoot development would permit absorption and recycling of nutrients from soil and prevent nutrient loss. To evaluate first-year effects of clear-cutting on soil leaching in aspen forests on different soil types, nitrate, ammonium, phosphate, potassium, calcium, sodium, iron, and magnesium ion losses from 60-year-old aspen stands in Michigan were evaluated. Soil-nutrient leachate ion concentrations were not significantly higher on clear-cut plots during the first growing season. Nitrate-nitrogen and ammonium-nitrogen leachate values were less than the seasonal precipitation input. Leachate concentrations were highest following the spring thaw, then fluctuated through the growing season. Highest nutrient losses were generally from good soils. Groundwater accretion was about 12 cm/year higher on clear-cut plots. A preliminary nutrient budget was calculated from input and output determinations. During the first year in controlled clear-cuts, there was little evidence of increased nitrate-nitrogen, ammonium-nitrogen, phosphate, magnesium, potassium, sodium, and iron losses due to clear-cutting. Losses of leachate calcium and magnesium above control levels due to clear-cutting exceeded precipitation inputs only on good soil. Definite answers about nutrient losses cannot be determined until complete nutrient and hydrologic budgets are determined. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10315

THE EFFECT OF NONREMOVAL CLEAR-CUTTING AND PINE REFORESTATION OF THE CATION COMPOSITION OF A HARDWOOD FOREST SOIL,
Environmental Protection Agency, Washington, D.C. Office of Environmental Sciences.
J. D. Yount.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 744-753. 3 fig, 1 tab, 12 ref. NSF AG 199,40-193-69.

Descriptors: *Clear-cutting, *Reforestation, *White pine trees, *Cations, *Forest soils, Hardwood, Deciduous forests, North Carolina, Nutrient requirements, Hydrogen ion concentration, Sodium:, Potassium, Calcium, Magnesium, Cation exchange, Soil horizons.
Identifiers: Coweeta Hydrologic Laboratory(NC).

Soil studies were conducted in a deciduous hardwood forest and a white pine plantation established after clear-cutting and decay of previous vegetation at the Coweeta Hydrologic Laboratory, North Carolina. Soil under the pine forest, which had been planted 14 years after clear-cutting and was 15 years-old, differed from the control hardwood forest soil in the opposite direction to that expected, based on relative nutrient demands of young pine and mature hardwood forests. Pine soil pH was 5.8 most of the year and was very well buffered, while hardwood soil pH was below 5.0. Sodium levels were similar, but potassium was higher in the hardwood soil, and calcium and magnesium were higher in the pine soil. Calcium took up 1/3-1/2 the total cation exchange capacity of pine soil. Cation exchange capacity and percent base saturation were significantly higher in pine soil; these characteristics produced a buffering effect resulting in less variable pH in pine soil. Differences in calcium, pH, and base saturation between the two soils can probably be attributed primarily to calcium input from clear-cutting and decay of plant biomass in the pine ecosystem. Soil calcium, pH, and base saturation in the pine forest should decrease to a lower steady-state level in time. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10322

EFFECTS OF FOREST FIRES ON ATMOSPHERIC LOADS OF SOLUBLE NUTRIENTS,
Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology.
W. M. Lewis.

In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 833-846. 2 fig., 3 tab., 35 ref. AEC AT(38-1)-819.

Descriptors: *Nitrogen cycle, *Forest fires, *Cycling nutrients, *Pine trees, Litter, Cations, Sulfates, Phosphates, Silicates, Carbon, Hydrogen, Oxygen, Nitrogen, Organic matter, Inorganic compounds, Hydrogen ion concentration, Conductivity, Solubility, Nitrates, Nitrites, Ammonia, Precipitation(Atmospheric), Phosphorus.
Identifiers: Longleaf pine.

Output of soluble substances from fires in longleaf pine litter by volatilization and particulate emission was determined by burning under controlled conditions. After combustion water-soluble substances released by the fire were extracted from the air. Combustion did not produce significant amount of airborne cations, sulfates, orthophosphates, or reactive silicates but volatilized carbon, hydrogen, oxygen, and nitrogen in the form of soluble organic and inorganic nitrogen compounds. These combustion products lowered the pH and conductance of water used in extraction. Approximately one-third of the unburned litter nitrogen content was released; most nitrogen was not recovered as fixed inorganic nitrogen. No nitrates were produced, but nitrite concentration was very high. Total nitrite and ammonia release from litter forest fires was approximately equal to two-thirds the yearly input of fixed nitrogen in rain. Field fires consume more fuel and burn hotter, thus volatile fixed nitrogen output would increase; therefore forest fires could increase regional and global atmospheric fixed nitrogen supplies. Atmospheric links of the nitrogen and possibly the phosphorus cycle are affected by open burning of forest materials and may be a source of atmospheric nutrients. Over long periods rainfall can be important in determining the nutrient inventory of the standing crop. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10328

THE EFFECT OF URBAN LAND USE ON NUTRIENT AND SUSPENDED-SOLIDS EXPORT FROM NORTH FLORIDA WATERSHEDS,
Florida State Univ., Tallahassee. Dept. of Oceanography.
R. R. Turner, R. C. Harris, T. M. Burton, and E. A. Laws.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 868-888. 3 fig., 4 tab., 30 ref.

Descriptors: *Land use, *Nutrients, *Suspended solids, *Storm runoff, *Urban runoff, Forest watersheds, Urbanization, Florida, Agricultural watersheds, Temporal distribution, Streamflow, Dissolved solids, Nitrates, Ammonia, Nitrogen, Nitrites, Phosphorus, Silca, Water quality control, Storm water.
Identifiers: Lake Jackson(Fla).

Two watersheds near Lake Jackson, Florida, representing forested-agricultural and residential-commercial land use were hydrologically instrumented to study nutrient and suspended solids export. Large differences in size and temporal distribution of nutrient and suspended solids concentrations and exports in storm runoff were observed. Urbanization increased peak stream discharge; total stream discharge volume; mean dissolved solids, nitrate, and ammonia concentrations under all streamflow conditions; mean suspended solids, dissolved solids, nitrate-nitrogen, nitrite-nitrogen, ammonia-nitrogen, and orthophosphorus concentrations under storm-flow conditions; stream water composition variability under all streamflow conditions; storm dissolved and suspended constituent export rates; total storm export of dissolved and suspended constituents except dissolved silicon; and relative significance of storms as transport mechanisms. It decreased mean dissolved silicon under all streamflow conditions and mean suspended solids, orthophosphorus, and total dissolved phosphorus concentrations under low streamflow conditions. Urban runoff water quality criteria should be based on loading rates and concentrations. Urban water quality monitoring systems should sample complete storm hydrographs. Plans for beneficial storm water use may have to include differential collecting systems to be effective. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10331

4D. Watershed Protection

EFFECTS OF LARGE SCALE FOREST FIRES ON WATER QUALITY IN INTERIOR ALASKA,
National Environmental Research Center, College, Alaska. Arctic Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W76-10045

MICROBIOLOGY AND CHEMISTRY STUDIES OF WATER QUALITY FACTORS IN A WATERSHED USED FOR MUNICIPAL SUPPLY AND WASTE DISPOSAL,
Montana State Univ., Bozeman. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 5B.
W76-10263

REDISTRIBUTION OF CESIUM-137 IN SOUTHEASTERN WATERSHEDS,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W76-10295

LITTER PRODUCTION, DECOMPOSITION, AND NUTRIENT CYCLING IN A MIXED HARDWOOD WATERSHED AND A WHITE PINE WATERSHED.
Georgia Univ., Athens. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W76-10310

MINERAL CYCLING STRATEGIES OF TWO DECIDUOUS AND TWO EVERGREEN TREE SPECIES ON A SOUTHERN APPALACHIAN WATERSHED,
Georgia Univ., Athens. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W76-10321

CATION FLUX IN HARDWOOD AND WHITE PINE WATERSHEDS,
Georgia Univ., Athens. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W76-10329

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

RETENTION OF METALS IN SEWAGE SLUDGE II: INCORPORATED RADIOISOTOPES,
Agricultural Research Service, Beltsville, Md. Agricultural Environmental Quality Inst.
J. V. Lagerwerff, G. T. Biersdorf, and D. L. Brower.
Journal of Environmental Quality, Vol. 5, No. 1, p 23-25, January-March, 1976. 5 tab, 20 ref.

Descriptors: *Metals, *Sewage sludge, *Radioisotopes, Analytical techniques, Sludge analysis, Sampling, *Pollutant identification, Waste water treatment.

Digested sewage sludge samples from Washington, D. C., and Baltimore, Maryland, were columned and leached for up to 240 hr with 0.06 N calcium chloride, as well as with water, to study the release of trace amounts of strontium 85 and cesium 137 introduced earlier. Other sludge samples were subjected to hydrogen peroxide treatment and steambath drying, then to incubating with strontium 85 and cesium 137, and either exhaustive water leaching or equilibration with 0.01 N hydrochloric acid or water for one hr. In terms of the original radioactivity, pretreatment increased release of cesium 137 by water leaching between 9 and 18%, and between 7 and 10% for Baltimore and Washington sludge, respectively, depending on whether pretreatment was with water or 3% hydrogen peroxide. For strontium 85, the corresponding ranges were 47 and 55%, and 41 and 48%. Incubation of sludge at room temperature for 44 mo increased water extractability of both cesium 137 and strontium 85 slightly when the material incubated was kept dry. This effect may have resulted from smaller complexing orgaic compound concentrations, or compounds with less complexing ability. The isotopes extractability with hydrochloric acid sharply increased when sludge was moist. This effect would also indicate more organic complexes when storage conditions were moist, since a pH decrease affects their stability. (Snyder-FIRL)
W76-10006

PHOSPHORUS DISTRIBUTION FROM SEPTIC TANK EFFLUENT IN COASTAL PLAIN SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W76-10015

OPTIMAL ALLOCATION OF MEASUREMENT AND CONTROL RESOURCES WITH APPLICATION TO RIVER DEPOLLUTION,
Columbia Univ., New York. Dept. of Mechanical Engineering.
N. M. Olgac, C. A. Cooper, and R. W. Longman.
IEEE Transactions on Systems, Man, and Cybernetics, Vol. SMC-6, No. 5, p 377-384, May, 1976. 6 fig, 24 ref.

Descriptors: *Model studies, Rivers, *Water pollution control, *Aeration, Dissolved oxygen, Biochemical oxygen demand, Costs, Waste discharge, Equations, *Pollutant identification.

Under suitable circumstances, artificial instream aeration is the preferred abatement method for river pollution. An optimal aeration strategy was developed operating on measurements of dissolved oxygen (DO) and biochemical oxygen demand (BOD). DO measurements, which are relatively inexpensive and essentially instantaneous, were modeled as having no cost or time lag. Constraints in measurement of BOD are contamination by noise, time lag, and expense of collecting data. Partial differential equations describe the relationship between DO, BOD, effluent discharges, and artificial aeration. Without loss of generality, this distributed parameter control problem was transformed into a set of lumped parameter control problems along characteristic lines of the original partial differential equations. A model resulted which is adequate for arbitrary temporal and spatial distributions of effluent discharge and variable river cross sections. This ordinary differential equation model was transformed to a discrete time model because of the inherently discrete nature of the BOD measurements. The model includes uncertainty in the a priori knowledge of effluent source rates and in all water quality measurements. Optimal assignment of valuable efforts between aeration and measurement of BOD was made in terms of this model. This optimal strategy is independent of the measurement values. Numerical calculations were also made indicating how BOD measurements can be best located along a river. The dependence of the

optimal measurement strategy upon observation noise variance and time lag were numerically investigated. (Snyder-FIRL)
W76-10017

A SIMULATION OF WATER POLLUTION MODEL PARAMETER ESTIMATION,
National Aeronautics and Space Administration, Langley Station, Va. Langley Research Center.
For primary bibliographic entry see Field 5B.
W76-10021

COMPUTER-AIDED ANALYSIS OF ENVIRONMENTAL DATA, PART I: LINEAR REGRESSION, PRECISION AND ACCURACY,
New York State Dept. of Environmental Conservation, Albany.
M. H. Wang, and L. K. Wang.
In: Proceedings of the 22nd Annual Technical Meeting of the Institute of Environmental Sciences, April 26-28, Philadelphia, Pennsylvania, p 543-547. 1 fig, 3 tab.

Descriptors: *Analytical techniques, *Computer models, *Computer programs, Statistical methods, Regression analysis, Ultraviolet radiation, *Pollutant identification, Measurement, Chemical wastes.

A FORTRAN computer program has been developed which determines the linear regression model, coefficient of correlation, and precision and accuracy of environmental data. The precision and accuracy of a new direct ultraviolet analytical technique were determined. Samples of varying concentrations of cetyldimethylbenzylammonium chloride (CDBAC) in distilled water were analyzed. Graphically, the relationship between CDBAC concentration and absorbance appeared to be linear. The computer method produced a linear regression line independent of the investigator's judgment. This general computer program is suitable for use in analyzing all types of environmental data. (See also W76-10023) (Snyder-FIRL)
W76-10022

COMPUTER-AIDED ANALYSIS OF ENVIRONMENTAL DATA, PART II: BIOCHEMICAL OXYGEN DEMAND MODEL,
Rensselaer Polytechnic Inst., Troy, N. Y.
L. K. Wang, and M. H. Wang.
In: Proceedings of the 22nd Annual Technical Meeting of the Institute of Environmental Sciences, April 26-28, 1976, Philadelphia, Pennsylvania, p 548-552. 3 fig, 1 tab, 6 ref.

Descriptors: *Biochemical oxygen demand, *Model studies, *Mathematical models, Oxygen, Organic compounds, Nitrogen compounds, Computer models, *Computer programs, *Pollutant identification.
Identifiers: Carbonaceous oxygen demand, Nitrogenous oxygen demand.

A computer program was developed for the determination of the first-stage biochemical oxygen demand (BOD), the deoxygenation constant, and the correlation coefficient of the BOD mathematical model. BOD is defined as the quantity of oxygen utilized in the biochemical oxidation of organic matter in a specified time at a specified temperature. It is used to measure the concentration of organic pollutants. If an organic waste contains only carbonaceous matter, its ultimate carbonaceous oxygen demand (UOD), also called the first-stage BOD, is a constant. The oxygen needed to oxidize the ammonia formed when organic matter containing nitrogen is oxidized is the nitrogenous oxygen demand (NOD), also called the second-stage BOD. A relatively simple mathematical model for BOD, involving a linear plot, can be used to obtain UOD and the deoxygenation constant and the UOD and determining the correlation coefficient. The first subroutine derives the slope and intercept of the linear plot. Results are given for a set of experimental data used as an example. (See also W76-10022) (Snyder-FIRL)
W76-10023

EFFECT OF SURFACTANTS ON THE SPECTROPHOTOMETRIC DETERMINATION OF PHOSPHATE BY DIRECT AND EXTRACTION PROCEDURES,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
P. Pakalns, and H. T. Steman.
Water Research, Vol. 10, No. 5, p 437-441, 1976. 1 fig, 4 tab, 4 ref.

Descriptors: *Surfactants, *Pollutant identification, *Phosphate, *Spectrophotometry, *Detergents, Cations, Anions.
Identifiers: *Extraction method.

The effects of surfactants on determination of phosphate in water and waste water were studied. The surfactants investigated included pure cationic, anionic, and nonionic detergents; industrially prepared detergents; and a soap. Ascorbic acid and stannous chloride spectrophotometric methods and isobutyl acetate extraction were used for determining phosphate. For the spectrophotometric methods, the interference was very large for the cationic detergent but negligible for the biodegradable anionic detergents. The ascorbic acid method, which is simple and elegant, is recommended for routine determination of phosphate in most waters and waste waters containing surfactants. The results show that the standard addition procedure for the extraction method can be used only when the approximate surfactant concentration is known. Cationic and nonionic detergent levels must not exceed 2 and 10 ppm, respectively, but biodegradable anionic detergents do not interfere to at least 1000 ppm. However, compounds present in formulated detergents interfere badly. The extraction method should only be used with samples of at least 50 ml containing no more than 8 ppm of pure detergent. (Snyder-FIRL)
W76-10027

AN INSTRUMENT WITH INTERNAL CALIBRATION FOR MONITORING CHLORINE RESIDUALS IN NATURAL WATERS,
National Bureau of Standards, Washington, D. C.
G. Marinenko, R. J. Huggett, and D. G. Friend.
Journal of the Fisheries Research Board of Canada, Vol. 33, No. 4, p 822-826, April, 1976. 2 fig, 3 tab, 5 ref.

Descriptors: *Monitoring, *Chlorine, *Iodine, *Laboratory tests, *On-site investigations, *Pollutant identification, Rivers, Instrumentation.
Identifiers: Chlorine residuals.

A more sensitive field monitor was developed for low level chlorine concentrations. Iodine, resulting from oxidation of potassium iodide by chlorine residual, is measured amperometrically using a platinum microelectrode and a saturated calomel electrode. In the calibrator cell, which operates only when the system is being calibrated, a known amount of iodine is generated by coulometrically oxidizing iodide to iodine, the result being exactly the same as the reaction of chlorine with iodide in aqueous media. The water sample flows at a constant, known rate through the monitor, so that the ratio of electrically generated iodine flux to the water flux corresponds to the iodine concentration. Laboratory tests on the monitor included measurements of repeated quantitative dilutions of tap water and a solution prepared from commercial bleach. Field tests were performed during non-emergency conditions in streams in northern Maryland and during a fish kill in the James River. Data obtained indicated that the new instrument can measure chlorine concentrations down to a few parts per billion. It is portable and has direct read-out display in either microamperes or ppm of residual chlorine. (Snyder-FIRL)
W76-10028

POLLUTION MONITORING DOESN'T HAVE TO BE COSTLY,
Hewlett-Packard Co., Loveland, Colo.
V. Hebert.
Instruments and Control Systems, Vol. 49, No. 4, p 27-30, April, 1976. 6 fig.

Descriptors: *Monitoring, *Water pollution control, *Pollutant identification, Automation, Data collections, Waste water treatment, Data processing.
Identifiers: Data acquisition systems.

Automatic data acquisition systems (DAS) controlled by programmable calculators can effectively monitor pollution control systems. Electrical signals from transducers can be processed in the calculator. Pollution control monitoring includes legally required monitoring, monitoring which is necessary for engineering reasons, and informative monitoring which is helpful in running the system. A calculator based data acquisition system is used for pollution control monitoring at an electronic equipment plant. Automated systems are used to treat the diluted waste in rinse waters, but concentrated process wastes are treated under the direct control of a trained operator. The DAS gathers two kinds of information: the time and date of the data and the data itself. The signals from the transducers are analog signals, but a voltmeter converts them to digital information which the calculator can understand. The DAS can generate written data reports. The calculator based DAS has other potential applications, is versatile and easy to program, and is economically competitive with other systems that perform fewer functions. (Snyder-FIRL)
W76-10029

POTENTIOMETRIC DETERMINATION OF LOW LEVELS OF SIMPLE AND TOTAL CYANIDES,
Canada Centre for Inland Waters, Burlington (Ontario).
I. Sekerka, and J. F. Lechner.

Descriptors: *Heavy metals, *Pollutant identification, *Electrodes, *Potentiometers, Irradiation, Measurement.
Identifiers: *Cyanides.

A method was developed to determine simple and total cyanide concentrations by manual or automated direct potentiometry using a cyanide ion-selective electrode and the addition-known dilution technique. Samples for either simple or total cyanide determination must be treated chemically before measurement, and samples for total cyanide determination must also be irradiated with ultraviolet light. The method was used to determine cyanide ion down to 2 ppb. A procedure was developed to eliminate the interference caused by ions forming little-soluble salts of silver. Since cyanide in acid solution exists as dissolved hydrogen cyanide gas, which is not sensed by the electrode, only the apparent cyanide due to the interfering salts is determined by measuring at pH 2 to 3. This value is subtracted from cyanide measurements at pH 11.5 to determine the real cyanide concentration. The method is simple and efficient, and results obtained using it compare well with those obtained by a conventional method. (Snyder-FIRL)
W76-10030

APPLICATION OF A COMPUTER-BASED CHROMATOGRAPH FOR AUTOMATED WATER POLLUTION ANALYSES,
New Orleans Univ., La. Dept. of Biological Sciences.
B. Dowty, L. Green, and J. L. Laseter.
Journal of Chromatographic Science, Vol. 14, No. 4, p 187-190, April, 1976. 5 fig, 15 ref.

Descriptors: *Pollutant identification, *Gas chromatography, *Automation, *Organic compounds,

Analytical techniques, Measurement, Water analysis, Equipment, Monitoring, Separation techniques, Computer programs, Polymers.
Identifiers: Adsorbents.

An automated, computer-based gas chromatographic technique for the analysis of low molecular weight volatile organics extracted from drinking water by a modified headspace technique is described. The volatile organics are thermally desorbed from the water sample and displaced into the head-space by purging the sample with ultrapure helium. These displaced organics are then adsorbed on a polymer (Tenax-GC) material which is packed in a glass liner which in turn fits into a modified injection port of chromatograph. A Hewlett-Packard reporting gas chromatograph is modified to allow automated collection of volatile organics and their subsequent resolution by capillary chromatographic methods. On line data collection and reduction are achieved by a digital processor incorporated into the chromatograph. Commands establishing operating parameters and methods of data treatment are given via a keyboard. Automation of the procedure results in improved data reproducibility, with consecutive chromatograph analyses of the same sample showing retention time variabilities in the 0.01-0.1 sec range. The automated procedure can also be used to monitor industrial plant effluents and waste water treatment processes. (Kreager-FIRL)
W76-10038

CHEMICAL HAZARDS RESPONSE INFORMATION SYSTEM, A CONDENSED GUIDE TO CHEMICAL HAZARDS,
Coast Guard, Washington, D. C. Office of Marine Environment and Systems.
W. M. Benkert.
Available from the National Technical Information Service, Springfield, Va 22161, as AD/A-002 390, $12.00 in paper copy, $2.25 in microfiche. Report CG-446-1, January, 1974. 437 p, 400 tab.

Descriptors: *Water pollution, *Toxicity, *Coast Guard regulation, *Chemicals, Water pollution sources, Chemical industry, *Safety, *Public Health, *Poisons, Ships, Inorganic compounds, *Chemical properties, Chemical wastes, Organic compounds, Human pathology, Transportation, Barges, Access routes, Navigation, Information exchange, Pollutant identification.
Identifiers: *Chemical hazards.

A condensed guide to chemical hazards is provided as guidance for proper decision making by responsible Coast Guard personnel. It also provides certain basic non-emergency related information to support Coast Guard effort to achieve improved levels of safety on the bulk shipment of hazardous chemicals. Included is: technical name, common synonums, physical characteristics of substance, emergency procedures, fire procedures, human exposure considerations and water pollution effects. (Katz)
W76-10047

EVALUATION OF THE ARMY PESTICIDE MONITORING PROGRAM, EVALUATION OF DATA FROM ENVIRONMENTAL SAMPLES COLLECTED PRIOR TO 1 JANUARY 1974, PART I, SOIL, SEDIMENT, WATER,
Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
C. C. Roan.
Available from the National Technical Information Service, Springfield, Va 22161, as ADA-003 228, $5.00 in paper copy, $2.25 in microfiche. Epidemiological Special Study No. 44-004-74/75, 1 September 1975. 8 p., 5 tab.

Descriptors: Pesticides, *Pesticide residues, Integrated control measures, Dieldrin, Aldrin, Endrin, DDT, DDE, DDD, Surface water, Sediment, Soils, *Monitoring, *Chlorinated hydrocarbon pesticides, *Pollutant identification.
Identifiers: Chlordane.

Analyses for pesticide residues in 389 environmental samples comprised of soil, water and sediment do not indicate extensive, unwarranted environmental contamination associated with the use of pesticides on Army installations. Revised scheduled sampling programs and a continuing evaluation of the pesticide component of the Army's integrated pest management programs are recommended. (Katz)
W76-10048

EFFECTS OF THERMAL AND CHEMICAL DISCHARGES FROM NUCLEAR POWER PLANTS,
Battelle Pacific Northwest Labs., Richland, Wash.
For primary bibliographic entry see Field 5C.
W76-10051

WATER QUALITY DATA FROM TRUCKEE AND CARSON RIVERS. PYRAMID LAKE AND LAHONTAN RESERVOIR, A WORKING PAPER.
Environmental Protection Agency, San Francisco, Calif.
For primary bibliographic entry see Field 5C.
W76-10054

ZINC PHOSPHATE GRANULES IN TISSUE SURROUNDING THE MIDGUT OF THE BARNACLE BALANUS BALANOIDES,
Natural Environment Research Council, Anglesey (Wales). Unit of Marine Invertebrate Biology; and University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 5C.
W76-10057

EFFECT OF TEMPERATURE AND TEMPERATURE ADAPTATION ON CALCIFICATION RATE IN THE HERMATYPIC CORAL POCILLOPORA DAMICORNIS,
Loma Linda Univ., Calif. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W76-10059

ULTRASTRUCTURAL CHANGES IN THE HEPATOCYTES OF GREEN SUNFISH, LEPOMIS CYANELLUS RAFINESQUE, EXPOSED TO SOLUTIONS OF SODIUM ARSENATE,
Texas Univ. at Austin. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W76-10062

TIDALLY-PRODUCED INTERNAL BANDS ON THE SHELL OF ELMINIUS MODESTUS,
Natural Environment Research Council, Angelsey (Wales). Unit of Marine Invertebrate Biology; and University Coll. of North Wales, Menai Bridge. Marine Science Labs.
D. J. Crisp, and C. A. Richardson.
Marine Biology, Vol. 33, No. 3, p. 155-160, 1975. 1 fig., 3 tab., 6 ref.

Descriptors: *Marking techniques, *Calcium, *Strontium, *Intertidal areas, *Growth rates, Environmental effects, *Tidal effects, Tides, *Crustaceans, Metals, Analytical techniques, Methodology, Invertebrates, *X-ray analysis, Pollutant identification, Path of pollutants.
Identifiers: Growth bands, Elminius modestus, *Barnacles.

Young specimens of Elminius modestus were marked by treatment with calcium and strontium-enriched sea water, allowed to grow in the intertidal environment, and marked again. The number of growth bands laid down coincided with the number of tidal immersions. Strontium is not readily incorporated into the shell, even when its concentration in the external environment is greatly increased. (Katz)
W76-10065

PHYSICAL FACTORS CONTROLLING ABUNDANCE OF MEIOFAUNA ON TIDAL AND ATIDAL BEACHES,
Jordan Univ., Amman. Marine Science Programme.
N. C. Hulings, and J. S. Gray.
Marine Biology, Vol. 34, No. 1, p. 77-84, 1976. 4 fig., 4 tab., 15 ref.

Descriptors: *Currents(Water), *Connate water, *Regression analysis, Statistical models, Beaches, Populations, Sands, *Temperature, *Fauna, Environmental effects, Mathematical studies, Analytical techniques, Animal populations, Distribution patterns, Biological communities, Bioindicators, Water quality control, Sediments, Pollutant identification.
Identifiers: *Meiofauna, *Mediteranean, Morocco, Algeria, Tunis Tidal Beaches, Atidal Beaches.

Quantitative samples of interstitial sand beach meiofauna were collected from Morocco along the North African coast and north to Lebanon, Turkey, and Cyprus. Data on the sediment median diameter, sorting coefficient, and beach temperature were used to construct multiple-regression equations relating these factors to total meiofaunal numbers. For the tidal beach equations sorting was the most important factor followed by temperature and median diameter. It is suggested that the factors controlling meiofaunal abundance on these beaches are likely to be wave, tide and current action which also control sorting. Biological interactions on atidal beaches may cause the poor fit of the data to the model. Regression techniques may be useful in pollution detection. (Katz)
W76-10069

THE IMPORTANCE OF DISSOLVED ORGANIC COMPOUNDS IN SEA WATER FOR THE NUTRITION OF ANEMONIA SULCATA PENNANT (COELENTERATA),
Cologne Univ. (West Germany). Zoological Institut.
For primary bibliographic entry see Field 5C.
W76-10071

TOXICITY OF POLYCHLORINATED BIPHENYLS (AROCLOR 1254) TO ADULT, JUVENILE AND LARVAL STAGES OF THE SHRIMP PALAEMONETES PUGIO,
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W76-10075

EFFECTS OF CALCIUM, STRONTIUM, AND MAGNESIUM ON THE COCCOLITHOPHORID CRICOSPHAERA (HYMENOMONAS) CARTERAE. I. CALCIFICATION,
South Carolina Univ., Columbia. Electron Microscope Lab.
For primary bibliographic entry see Field 5C.
W76-10078

BODILY DISTRIBUTION, ACCUMULATION AND EXCRETION OF MERCURY IN A FRESHWATER MUSSEL,
Siena Univ. (Italy). Inst. of Comparative Anatomy.
For primary bibliographic entry see Field 5C.
W76-10081

DISTRIBUTION OF SELECTED METALS IN TISSUE SAMPLES OF CARP, CYPRINUS CARPIO,
Marist College, Marist Coll., Poughkeepsie, N. Y. Environmental Science Program
For primary bibliographic entry see Field 5C.
W76-10082

ASYMMETRY ANALYSIS IN FISHES: A POSSIBLE STATISTICAL INDICATOR OF ENVIRONMENTAL STRESS,
Dames and Moore, San Francisco, Calif.
For primary bibliographic entry see Field 5C.
W76-10121

DESIGN A RIVER BASIN SAMPLING SYSTEM,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
T. G. Sanders, B. B. Berger, and D. D. Adrian.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-255 022, $5.00 in paper copy, $2.25 in microfiche. Massachusetts Water Resources Research Center, Amherst, Publication No. 62, Completion Report FY-76-9, March 1976. 88 p, 12 fig, 14 tab, 77 ref. OWRT A-041-MASS(4) 14-31-0001-4021.

Descriptors: *Sampling, *Design criteria, *Pollutant identification, *River basins, Water quality, *Time series analysis, *Frequency, Streams.

The major objectives were: (1) To develop criteria to be used for specifying the number of sampling points in a river basin and their longitudinal, lateral and vertical location. (2) To develop criteria which would specify the frequency of sampling for baseline concentrations and year-to-year trends. The general location of sampling stations was specified by means of a stream numbering system. This location, termed the macrolocation, was then further refined by considerations of upstream discharges which might influence the longitudinal, lateral and vertical variation in pollutant concentrations. A representative sample of water quality in the stream's transect may require compositing samples withdrawn from various portions of the stream. A time series model was used to determine trends and to investigate the efficacy of various sampling frequencies.
W76-10131

THE MEASUREMENT OF ADENOSINE TRIPHOSPHATE IN PURE ALGAL CULTURES AND NATURAL AQUATIC SAMPLES,
Geological Survey, Doraville, Ga.
W. T. Shoaf, and B. W. Lium.
Journal of Research of the U S Geological Survey, Vol 4, No 2, p 241-245, March-April 1976. 3 fig, 4 tab, 9 ref.

Descriptors: *Chemical analysis, *Algae, Natural streams, *Analytical techniques, Sampling, Preservation, Methodology, Biochemistry, Biomass, Aquatic microbiology, Measurement, *Pollutant identification, *Separation techniques.
Identifiers: *Adenosine triphosphate.

Three methods for the extraction of adenosine triphosphate (ATP)--neutral dimethyl sulfoxide (DMSO), boiling tris buffer, and butanol-octalol extraction--were equally effective on the alga Chlorella vulgaris. Dilution of extracted ATP samples was linear. Filtration of different volumes of samples resulted in proportional values for ATP in the extracts. Measurement of activity by either peak height of integration of the area under the peak were equally sensitive and reproducible. The assay of ATP sample was inhibited by mercuric chloride >cadmium chloride >calcium chloride >potassium or sodium phosphate, and by high concentrations of the extractant DMSO. Analysis of ATP in aquatic environments led to the problem of transferring a sample from the field to the laboratory without obtaining a change in ATP concentration. Quick freezing by immersion of filter and algae in liquid nitrogen and storage on dry ice maintained a constant ATP level. Field extraction of the ATP followed by quick freezing in an acetone--dry ice bath maintained the ATP in a convenient and stable form. (Woodard-USGS)
W76-10133

RECONNAISSANCE DATA ON LAKES IN WASHINGTON--VOLUME 6. ADAMS, BENTON, DOUGLAS, FRANKLIN, GRANT, LINCOLN, WALLA WALLA, AND WHITMAN COUNTIES,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 7C.
W76-10138

RECONNAISSANCE DATA ON LAKES IN WASHINGTON--VOLUME 7. PEND OREILLE, SPOKANE, AND STEVENS COUNTIES,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 7C.
W76-10139

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMEO, COLORADO TO CISCO, UTAH: PART 1. DATA SUMMARY,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 7C.
W76-10142

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMEO, COLORADO, TO CISCO, UTAH: PART 2. BASIC DATA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 7C.
W76-10143

CONTINUOUS RESPIROMETER APPARATUS FOR MONITORING SEWAGE OXYGEN CONTENT.
Robertshaw Controls Co., Richmond (Australia). (Assignee).
Australian Patent 470,334. Issued March 11, 1976. Official Journal of Patents, Trade Marks and Designs, Vol. 46, No. 8, p 773, March, 1976.

Descriptors: *Sewerage, Analytical techniques, *Oxygen, *Monitoring, *Patents, Dissolved oxygen analyzers, Measurement, Aeration, *Pollutant identification, Waste water treatment.
Identifiers: *Respirometers.

A continuous respirometer apparatus to monitor the oxygen contained in sewage in a holding area was patented. It includes a continuous closed flow path formed on its upstream end with an inlet sensing area, and an outlet sensing area on its downstream end. A residence chamber is defined, having a known volume. A pre-aeration vessel is included with an outlet connected to the inlet in the closure area and an inlet for receiving the fluid. Means are included to introduce oxygen to the pre-aeration vessel to add oxygen to the fluid. Outlet and inlet probes sensing oxygen content are disposed in the outlet and inlet sensing areas to continuously sense the oxygen content of the sewage flowing through the outlet and inlet areas. The invention includes supply conduits that lead from the holding area to the pre-aeration vessel inlet to deliver sewage. Dump conduits lead from the outlet sensing area. Sewage delivery equipment continuously delivers sewage to the inlet sensing area. The sewage delivery rate is predetermined to maintain the volume filled and to provide a known residence time required for the sewage to flow between the inlet probe and outlet probe. The means for sewage delivery may be actuated for continuous delivery to the inlet sensing area, also causing flow of the sewage from the inlet probe to the outlet probe while isolated from ambient oxygen and causing the probes to indicate the oxygen content of the sewage at both the outlet and inlet sensing areas. (Snyder-FIRL)
W76-10201

BIODEGRADABILITY--AN IMPORTANT CRITERION FOR THE ENVIRONMENTAL COMPATIBILITY OF SURFACTANTS AND OTHER PRODUCT COMPOUNDS,
Henkel and Cie G.m.b.H., Duesseldorf (West Germany).
W. K. Fischer.
La Rivista Italiana Delle Sostanze Grasse, Vol. 52, No. 11, p 373-376, November, 1975. 3 fig, 6 tab, 1 ref.

Descriptors: *Pollutant identification, Analytical techniques, *Biochemical oxygen demand, *Chemical oxygen demand, *Carbon dioxide, Organic matter, Organic compounds, Carbon, Activated sludge, *Biodegradation, Water quality standards.
Identifiers: Total organic carbon, Dissolved organic carbon.

Biodegradability is increasingly required by national laws and international directives. The biodegradability testing of anionic surfactants stimulates either the self-purification of surface waters or biological sewage treatments in activated sludge plants in static and continuous flow systems. Biodegradability is being demanded increasingly for all organic product components. These demands pose new problems in testing methodology, international comparability, practical relevance of the results, and definition of official minimum requirements. A test combination has been developed consisting of successive application of a screening test and a model sewage treatment plant test; it permits the biodegradability evaluation of organic compounds by means of generally applicable summary parameters. The biodegradation of all organic materials can be determined via the biochemical oxygen demand (BOD) with the Closed Bottle Test. Similar determinations can be made via chemical oxygen demand (COD), total organic carbon (TOC), dissolved organic carbon (DOC) and carbon dioxide with the modified Closed Bottle Test using pure oxygen saturation. The low concentrations used in the conventional Closed Bottle Test make it useful only for BOD. If these screening tests yield low or questionable degradation rates, a modified confirmatory test especially suited to summary parameters is used to establish the elimination rates attainable under sewage treatment conditions. In the continuous activated sludge test, biodegradability may be observed by comparing values of COD, TOC, or both in coupled activated sludge units. (Snyder-FIRL)
W76-10235

DETERMINATION OF THE CHEMICAL OXYGEN DEMAND (COD) BY POTASSIUM DICHROMATE AT VERY HIGH CHLORIDE CONCENTRATIONS (BESTIMMUNG DES CHEMISCHEN SAUERSTOFFBEDARFS (CSB) GEGEN KALIUMDICHROMAT BEI SEHR HOHEN CHLORIDKONZENTRATIONEN),
U. Zietz.
Gas-und Wasserfach-Wasser/Abwasser, Vol. 117, No. 4, p 181-184, 1976. 1 tab, 10 ref.

Descriptors: *Chemical oxygen demand, *Potassium compounds, Analytical techniques, *Chlorides, *Chemical precipitation, Solubility, Axidation, Aqueous solutions, *Pollutant identification.
Identifiers: Potassium dichromate.

A modification of the potassium dichromate method for the determination of the chemical oxygen demand (COD) at very high chloride concentrations without the use of mercury compounds is described. The determination requires closed vacuum flasks for the analysis. Chlorides are quantitatively precipitated in the form of silver chloride. The small chloride concentration resulting from the solubility product of silver chloride is oxidized by the potassium dichromate. The chlorine concentration in the gaseous phase over the solution is negligible. The method is suitable for the determination of even very low COD values. (Takacs-FIRL)
W76-10236

ANALYTICAL NOTES--ELECTROCHEMICAL METHOD FOR EARLY DETECTION AND MONITORING OF COLIFORMS,
National Aeronautics and Space Administration, Langley Station, Va. Langely Research Center.
J. R. Wilkins, and E. H. Boykin.
American Water Works Association Journal, Vol. 68, No. 5, p 257-263, May, 1976. 4 fig, 4 tab, 11 ref.

Descriptors: *Analytical techniques, *Pollutant identification, *Electrochemistry, *Hydrogen, *Coliforms, Estuaries, Freshwater, Evaluation, Metabolism, Measurement, Aquatic microorganisms.
Identifiers: *Electrochemical methods, Fecal coliforms.

An electrochemical method for the detection and monitoring of coliforms in naturally contaminated estuarine and fresh water samples was evaluated. The method was based on the observation that the inoculum size was directly related to the time period required for the detection of hydrogen which is evolved by coliforms as a result of lactose metabolism. Standard methods of coliform analysis were performed on fresh water and estuarine samples, and membrane filtration counts were used to construct dose-response curves. Samples containing coliforms in the range of 100-1000/100 ml were detected in 6.2-8.5 hr for total coliforms in estuarine or fresh water samples, 3.5-6.5 hr for fecal coliforms in estuarine water, and 5.0-7.0 hr for fecal coliforms in fresh water samples. (Kreager-FIRL)
W76-10237

ANIONIC AND NON-IONIC SURFACTANT BIODEGRADATION IN A PURIFYING PLANT USING ACTIVATING MUDS (BIODEGRADAZIONE DE TENSIOATTIVI ANIONICI E NON-IONICI IN UN IMPIANTO DI TRATTAMENTO A FANGHI ATTIVATI),
Stazione Sperimentale Oli e dei Grassi, Milano (Italy).
C. Ruffo, and A. Arpino.
La Rivista Italiana delle Sostanze Grasse, Vol. 52, No. 11, p 383-386, November, 1975. 9 tab, 8 ref.

Descriptors: *Waste water treatment, *Pollutant identification, *Sewage treatment, *Activated sludge, *Sewerage, Treatment facilities, Surfactants, Muds, *Biodegradation.

Since surfactant-containing sewage must be adequately purified before final dumping sewage sampled both downstream and upstream of a purification plant using activated sludge was analyzed. The treatment removed more than 80% of both non-ionic and anionic surfactants. This situation indicates that biodegradable products are in use in Italy, as required by existing regulations. These results agree with those obtained by this research team in 1973, when despite drastically increased detergent consumption, surfactant concentration levels had not significantly risen since 1964. (Snyder-FIRL)
W76-10238

ANALYZING FOR ASBESTOS IN DRINKING WATER,
Municipal Environmental Research Lab., Cincinnati, Ohio.
J. R. Millette.
News of Environmental Research in Cincinnati, p 1-4, January 16, 1976. 4 fig.

Descriptors: *Pollutant identification, *Analytical techniques, *Asbestos, *Potable water, *Electron microscopy, Asbestos cement, Public health, Concrete pipes, Water conveyance, Water supply.

Although the health effects of asbestos fibers in drinking water currently are not known, sufficient concern exists that the levels should be investigated. An electron microscope is used for routine asbestos analysis because it can be used to identify fibers by crystal structure, morphology, and elemental composition. Samples from throughout the country were analyzed, indicating that a few municipal water supplies have relatively high asbestos levels, and that water with certain chemical characteristics may cause asbestos fibers to be released from asbestos cement pipe into water systems. (Snyder-FIRL)
W76-10240

IMPORTANT ASPECTS OF PHOSPHORUS ANALYSIS,
Allied Chemical Corp., Morristown, N. J.
H. E. Zuern.
Water and Sewage Works, Reference number, p R-52-R-53, April 30, 1976. 1 ref.

Descriptors: *Phosphorus, *Analytical techniques, *Colorimetry, *Pollutant identification, *Waste water(Pollution), Organophosphorus compounds, *Phosphates.
Identifiers: Ortho phosphate, Poly phosphates, Sample preparation, Digestion techniques.

Methods for the analysis of phosphorus in waste water are reviewed. All poly and organic phosphates must first be converted to ortho phosphate in order to determine the phosphorus content of a waste water sample. This is done by digesting the sample through chemical addition and heating. Three digestion techniques are suggested in Standard Methods: perchloric acid, sulfuric-nitric acid, and persulfate. The persulfate method is recommended for most waste water laboratories since it involves minimum hazards. After the digestion procedure, samples are checked for clarity to determine if filtering or centrifuging is necessary prior to colorimetric phosphorus determination. Suitable colorimetric methods include: the stannous chloride method which has a useful range of 0.007-2.0 mg/liter, the ascorbic acid method which has a useful range of 0.03-2.0 mg/liter, and the vanadomolybdophosphoric method which has a useful range of 0.75-20 mg/liter. The last method requires only one chemical for color development and is suitable for most field work where minute accuracy is not required. The stannous chloride method is preferred when small quantities of phosphorus (less than 2.0 mg/liter) are to be determined. (Kreager-FIRL)
W76-10241

POLLUTANT ANALYSIS COST SURVEY,
National Bureau of Standards, Washington, D. C.
B. Greiler, and J. K. Taylor.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-241 991, $7.75 in paper Copy, $2.25 in microfiche. Report EPA 650/2-74-125, December 1974, 196 p, 4 fig, 30 tab, 186 ref.

Descriptors: *Pollutant identification, *Water pollution, *Industrial wastes, *Testing, *Cost analysis, Spectrophotometry, X-ray fluorescence, Spectroscopy, Polarographic analysis, *Trace elements.
Identifiers: Emission spectroscopy, Electron probes, Polarography.

Various approaches to chemically analyzing heavy industrial process materials and effluents for trace elements possibly contributing to environmental pollution are summarized. The costs and capabilities of nuclear methods, spark source spectrometry, atomic absorption spectrometry, voltammetry, and potentiometry are assessed for determining traces of mercury, beryllium, cadmium, arsenic, vanadium, manganese, nickel, antimony, chromium, zinc, copper, lead, selenium, boron, fluorine, lithium, silver, tin, iron, strontium, sodium, potassium, calcium, silicon, magnesium, uranium, and thorium in matrices such as fly ash, oil, coal, ores, minerals, metals, organometallics, alloys, slurry streams, incinerator particulates, and feeds of sedimentation processes. A selected bibliography is included and the Standard Reference Materials available for environmental analysis are reviewed. This report revises and extends the 'Survey of Various Approaches to the Chemical Analysis of Environmentally Important Materials,' which it supersedes. (Snyder-FIRL)
W76-10259

WATER POLLUTION SAMPLER EVALUATION,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, Md.
J. J. Barkley, K. M. Peil, and J. W. Highfill.
Available from the National Technical Information Service, Springfield, Va 22161, as AD-A009 079, $6.75 in paper copy, $2.25 in microfiche. Technical Report 7501, January, 1975, 162 p. 24 fig, 39 tab, 6 ref, 5 append.

Descriptors: *Pollutant identification, *Analytical techniques, *Instrumentation, Sanitary engineering, *Water sampling, Laboratory tests, Testing procedures, Publications, Equipment.
Identifiers: *Sampler evaluation.

Standardized solutions and testing procedures for evaluating water and waste water samplers were studied. The ability of existing portable sampler to obtain representative samples of various waste water constituents under various physical limitations was evaluated. Sixteen samplers, representing the various types available, were tested with synthetic waste waters consisting of six classes of naturally occurring constituents. Test physical constraint included lift, temperature and sampling duration. Samplers were evaluated as to ease of operation representativeness of sample, and relation to a predefined ideal sampler and ranked as to overall performance. Only refrigerated samples maintained the level of biodegradable material. Gas-operated samplers inhibited bacterial viability in the sampled media, either because of the Freon or the rease associated with Freon. Collection velocity, constrictions, reductions or tees in the flow system, and screens or small holes in the inlet device influence the ability of a sampler to collect suspended solids. Temperature, time, and lift apparently do not significantly affect the collection or maintenance of colloids. No sampler was found efficient for sampling dissolved oxygen. Nonrepeatable result were obtained for the volatile organic class, possibly due to the fact that ambient temperature was not controlled and shortcomings in analytical procedure. Self-purging samplers were generally more efficient than non-purging models. (Snyder-FIRL)
W76-10261

MICROBIOLOGY AND CHEMISTRY STUDIES OF WATER QUALITY FACTORS IN A WATERSHED USED FOR MUNICIPAL SUPPLY AND WASTE DISPOSAL,
Montana State Univ., Bozeman. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 5B.
W76-10263

BORON AND ARSENIC STUDIES IN FLORIDA WATERS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5B.
W76-10265

EFFECTS OF AGE, SEX, AND PELAGE PHENOTYPE ON THE ELEMENTAL COMPOSITION OF THE OLD-FIELD MOUSE,
Savannah River Ecology Lab., Aiken, S. C.
G. A. Kaufman, and D. W. Kaufman.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 518-527. 3 tab., 20 tab., 20 ref. AT(38-1)-310, AT(38-1)-819.

Descriptors: *Trace elements, *Small animals(Mammals), Analysis, *Chemical properties, *Rodents, Laboratory animals, Bioassay, Calcium, Phosphorus, Potassium, Sodium, Magnesium, Iron, Zinc, Aluminum, Manganese, Strontium, Boron, Molybdenum, Sulfur, Southeast U.S., Cycling nutrients, *Pollutant identifica tion.
Identifiers: Mice, *Pelage phenotype.

Effects of age, sex, and two naturally occurring pelage phenotypes (dark and light brown) on whole-body elemental composition were analyzed in nonreproducing laboratory-raised old-field mice from 0 to 42 days-old. Their effects on dry weight, live weight, lean-dry- and lean-live-biomass concentrations of calcium, phosphorus, potassium, sodium, magnesium, iron, zinc, sulfur, aluminum, manganese, strontium, boron, molybdenum, and barium were studied, using analysis by variance. Age was the most important factor affecting concentrations of these elements; sulfur expressed as dry- and lean-dry-biomass concentrations and sodium expressed as live- and lean-live-biomass concentrations were not significantly changed by age. Sex significantly affected potassium and zinc when expressed as dry weight concentrations but did not affect any element when expressed as live-weight or lean-dry- or lean-live-biomasses. Pelage phenotype significantly affected strontium when expressed as live-weight or lean-dry- or lean-live-biomass concentrations but not when expressed as a dry-weight concentration, and had no effect on other elements. The variability due to age (size) should be removed before effects of other variables are studied and form of concentrations expression should be considered. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10301

PREDICTION OF ELEMENTAL CONTENT IN THE OLD-FIELD MOUSE,
Savannah River Ecology Lab., Aiken, S. C.
D. W. Kaufman, and G. A. Kaufman.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 528-535. 3 tab., 11 ref. AT(38-1)-310, AT(38-1)-819.

Descriptors: *Rodents, *Physicochemical properties, Analysis, *Small animals(Mammals), *Trace elements, Calcium, Phosphorus, Potassium, Sodium, Magnesium, Iron, Zinc, Aluminum, Sulfur, Manganese, Strontium, Boron, Molybdenum, Barium, Laboratory animals, Bioassay, Forecasting, Regression analysis, Chemical properties, Southeast U.S., Cycling nutrients, *Pollutant identification.
Identifiers: Mice.

Changes in elemental contents of laboratory-raised old-field mice from 0 to 6 weeks-old were studied to determine usefulness of live and dry weights in predicting elemental concentrations. Live weight and live-weight concentrations of calcium, phosphorus, potassium, sodium, magnesium, iron, zinc, aluminum, sulfur, manganese, strontium, boron, molybenum, and barium, and between dry weight and dry-weight concentrations of elements were compared as mere correlations for data transformed to natural logarithms. Equations for estimating elements present from mouse live- and dry-weights were used. Live-weight estimators were best for converting field biomass into elemental standing crops. Sodium and potassium were not correlated with live weight nor were phosphorus, iron, and zinc with dry weight. The best elemental content estimated for 0 to 6 weeks-old mice were by predicting natural logarithms of elements from natural logarithms of live weight. For trappable-size mice 3 to 6 weeks-old, average live-weight concentration was the best elemental content estimator. Elemental contents from dry weights of 0 to 6 and 3 to 6 weeks-old mice should be estimated from regression equations relating elements to dry weight logarithms. Nitrogen, magnesium, aluminum, strontium, molybdenum, and barium were lower in laboratory than field-caught animals. Element concentrations were size specific. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10302

FATHEAD MINNOWS (PIMEPHALES PROMELAS) AND GOLDFISH (CARASSIUS AURATUS) AS STANDARD FISH IN BIOASSAYS AND THEIR REACTION TO POTENTIAL REFERENCE TOXICANTS,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries, and Wildlife.
I. R. Adelman, and L. L. Smith, Jr.
Journal of the Fisheries Research Board of Canada, Vol. 33, p. 209-214, 1976. 3 tab.

Descriptors: *Minnows, *Toxicants, Laboratory tests, *Bioassay, Analytical techniques, *Bioindicators, *Sodium chloride, Methodology, Standards, *Phenols, Variability, Quality control, Water quality control, Lethal limit, Aromatic compounds, *Pollutant identification.
Identifiers: Pimephales promelas, Carassius auratus, Standard procedures, *Reference toxicants, *Goldfish, Guthion(R), Pentachlorophenol.

Fathead minnows (Pimephales promelas) and goldfish (Carassius auratus) were compared for their suitability as standard bioassay fish. Both species showed the same variability of bioassay results when tested with four toxicants. Fathead minnows are recommended on the basis of their small size and on their capability for use in complete life cycle tests. On the basis of minimum variability of bioassay results, sodium chloride was superior for use as a reference toxicant. Both sodium chloride and pentachlorophenol would be acceptable as a reference toxicant. (Katz)
W76-10336

DELTA-AMINO LEVULINIC ACID DEHYDRATASE ACTIVITY IN FISH BLOOD AS AN INDICATOR OF A HARMFUL EXPOSURE TO LEAD,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W76-10338

AROCLOR 1016: TOXICITY TO AND UPTAKE BY ESTUARINE ANIMALS,
Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W76-10340

THE IDENTIFICATION OF PHTHALIC ACID ESTERS IN THE TISSUES OF CYPRINODONT FISH AND THEIR ACTIVITY AS HEARTRATE DEPRESSORS,
Oak Ridge National Lab., Tenn.
P. Pfuderer, S. Janzen, and W. T. Rainey, Jr.
Environmental Research, Vol. 9, p. 215-223, 1975. 1 tab., 8 fig., 15 ref.

Descriptors: *Fish physiology, *Chemical analysis, *Bioassay, Water pollution effects, *Absorption, *Carp, *Industrial wastes, *Plastics, Chemical reactions, Spectrophotometry, Analytical techniques, Separation techniques, Laboratory tests, Water pollution sources, Adsorption, Chromatography, Lipids, *Pollutant identification.
Identifiers: Phthalates, Heart rate depressors.

Dioctyl phthalate and butylbenzyl phthalate, isolated from carp liver, exhibited heartrate depressor activity. A pure sample of dioctyl phthalate was not active in the assay, while a sample of butylbenzyl phthalate containing 1.5% dibutyl phthalate was slightly active, probably due to the dibutyl phthalate it contained. Dibutyl phthalate, also found in carp livers, remained active as a heartrate depressor at levels of 5 ppm and higher, in pure form. It is concluded either that traces of a compound that complexes or enhances the activity of dioctyl and butylbenzyl phthalate are responsible for their activity or traces of a more active compound are present with them. Dioctyl phthalate was also shown to form complexes in ethanol with fish lipids, presumably with fish di- and triglycerides. (Katz)
W76-10344

THE INFLUENCE OF HARDNESS COMPONENTS (CA2+ AND MG2+) IN WATER ON THE UPTAKE AND CONCENTRATION OF CADMIUM IN A SIMULATED FRESHWATER ECOSYSTEM,
Northeast Louisiana Univ., Monroe. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W76-10346

MICROBIAL PETROLEUM DEGRADATION: USE OF MIXED HYDROCARBON SUBSTRATES,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W76-10350

PROCEEDINGS OF THE CONFERENCE ON MARINE BIOLOGY IN ENVIRONMENTAL PROTECTION HELD AT SAN CLEMENTE ISLAND, CALIFORNIA ON 13-15 NOVEMBER, 1973.
Naval Undersea Center, San Diego, Calif.
For primary bibliographic entry see Field 5C.
W76-10353

PROBLEMS AND TECHNIQUES OF MARINE BIOLOGY IN THE FIELD: MODELING THE MARINE ECOSYSTEM,
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W76-10355

BIOLOGICAL CONSIDERATION OF A BIOASSAY SYSTEM,
Naval Ship Research and Development Center, Annapolis, Md.
For primary bibliographic entry see Field 5C.
W76-10359

A RELIABLE ALGAL ASSAY PROCEDURE BASED ON PH MEASUREMENTS,
Naval Research Lab., Washington, D.C.
P. J. Hannan.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California, on 13-15 November, 1973, December, 1974. p 71-88, 8 fig, 11 ref.

Descriptors: *Bioassay, *Algae, Methodology, Water quality, *Primary productivity, *Hydrogen ion concentration, *Toxicity, *Adsorption, *Absorption, Aquatic productivity, Carbon dioxide, Photosynthesis, Adaptation, Environmental effects, Laboratory analysis, Basic data collections, Mercury, Iron, Zinc.
Identifiers: Scandium, *pH changes, *Algal bioassay, Phaeodactylum tricornutum, Instant Ocean.

An assay method has been devised for laboratory and shipboard use, based on the pH changes associated with CO2 absorption by algae. It can be used to determine differences in water quality, or to rank the relative toxicities of various compounds. The equipment consists of a lighted aquarium with six 1-liter Erlenmeyer flasks containing the test suspensions, a sensitive pH meter, an automatic electrode switch, and a six-point recorder or a digital printer. Growth is monitored for 60 hours, and CO2 absorption for each suspension is calculated from a comparison of pH changes observed during growth of the test

suspension with those found during a titration of an aliquot with standard alkali. Close control of the inoculum concentration and of nutrient concentrations is essential for reproducible results; it has been possible to approach 1 percent accuracy throughout the course of the 60 hours with four duplicate cultures. Because this method provides a continuous measure of growth the data contains useful information concerning the adaptation, or lack of adaptation, of the cells to a toxicant. Adsorption phenomena which play an important role in bioassays with algae and other organisms are also discussed. (See also W76-10353) (Katz)
W76-10360

BYSSAL THREAD PRODUCTION AS A TOXICITY TEST,
Naval Undersea Center, San Diego, Calif.
M. H. Salazar.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California, on 13-15 November, 1973, December, 1974. p. 103-116, 1 tab., 4 fig., 4 ref.

Descriptors: *Toxicity, *Bioassay, Physiology, *Mollusks, *Chromium, *Copper, *Mercury, *Zinc, *Sewage, Pelycypods, Mussels, Physiology, Intertidal areas, Methodology, Water quality, Water pollution, Statistical analysis, *Pollutant identification.
Identifiers: *Byssal threads production test.

Byssal thread production in Mytilus edulis decreases significantly when these mussels are stressed by various pollutants. Statistical analysis has shown that this stress can be quantified and used as a reliable measure of toxicity. During the development of this test, the toxicity of heavy metals (lead, chromium, copper, zinc, and mercury), sewage, fuel biocides, synthetic polymers, and oil were evaluated. As it is now conducted the test takes 21 days to complete. Mussels and some other bivalves produce byssal threads to anchor themselves securely to solid substrate. Previous investigators have shown that the number of byssal threads produced by a mussel is a good indicator of general animal health. It was found that byssal thread production in Mytilus edulis and Modiolus demissus decreased when physical factors such as temperature, dissolved oxygen, salinity, pH, and agitation deviated from optimum levels. This study demonstrates a similar decrease when Mytilus edulis is stressed with toxicants. (See also W76-10353) (Katz)
W76-10362

THE ACTIVITIES OF ENZYMES AS POLLUTION INDICATORS,
San Diego State Univ., Calif.
J. H. Mathewson.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California, on 13-15 November, 1973, December, 1974, 117-124, 9 ref.

Descriptors: *Crustacean, *Marine animals, *Toxicity, *Bioassay, Methodology, Laboratory methods, Animal physiology, Biochemistry, *Enzymes, Environmental studies, Mercury, Cadmium, *Bioindicators.
Identifiers: *Enzyme activity measurements, California spiny lobster, Panuliris interruptus, Carbonic anhydrase.

Traditional methods for the prediction of the impact of the pollutant on ecosystems rely on the short-term and generally gross response of uniform collection of mature specimens of a single species to relatively massive doses of a contaminant. The accepted concepts of modern ecology and the subtle and often surprising responses of ecosystems to perturbation require more sophisticated analysis. One approach is the determination of the response of key enzymes in exposed or sensitive tissue to environmentally significant levels of pollutants. Two potentially useful systems for the study of marine pollution problems are the carbonic anhydrases controlling carbon dioxide exchange and the cation dependent ATPases controlling ion balances.
W76-10363

COMPARISON OF TOXICITY TESTS,
Naval Undersea Center, San Diego, Calif.
For primary bibliographic entry see Field 5C.
W76-10367

MARINE POLLUTION MONITORING (PETROLEUM). PROCEEDINGS OF A SYMPOSIUM AND WORKSHOP,
National Oceanographic and Atmospheric Administration, Rockville, Md.
For primary bibliographic entry see Field 5B.
W76-10370

SURVEY ANALYSES FOR PETROLEUM DERIVED HYDROCARBONS IN THE OCEAN,
Maritime Safety Agency, Tokyo (Japan). Oceanographic Div.
For primary bibliographic entry see Field 5B.
W76-10374

MARINE POLLUTION DATA ARCHIVING AND EXCHANGE,
National Oceanic and Atmospheric Administration, Silver Spring, Md. Environmental Data Service.
R. M. Morse.
In: NBS Special Publication No 409, Marine Pollution Monitoring (Petroleum). Proceedings of a Symposium and Workshop, December, 1974. p. 41-44.

Descriptors: *Data transmission, *Water pollution, *Data collections, International waters, Water quality sampling, Monitoring, Continuous water pollution control, Federal government.
Identifiers: International Oceanographic Data Exchange(IODE), U.S. Environmental Data Exchange(ENDEX).

The efforts of the United States Government and international agencies including UNESCO to collect and coordinate oceanographic data which applies to the evaluation of marine pollution is outlined. (See also W76-10370) (Katz)
W76-10376

QUANTITATIVE MONITORING AND VARIABILITY OF PELAGIC TAR IN THE NORTH ATLANTIC,
Harvard University, Cambridge, Mass. Dept. of Engineering and Applied Physics.
For primary bibliographic entry see Field 5B.
W76-10378

TAR BALL LOADINGS ON GOLDEN BEACH, FLORIDA,
Coast Guard Research and Development Center, Groton, Conn.
For primary bibliographic entry see Field 5B.
W76-10379

TAR BALL SAMPLING IN THE WESTERN NORTH ATLANTIC,
Coast Guard Research and Development Center, Groton, Conn.
For primary bibliographic entry see Field 5B.
W76-10380

EVALUATION OF THIN FILM OIL SAMPLERS,
Coast Guard, Washington, D.C.
W. J. Chang, and J. R. Jadamac.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 85-88, 1 tab., 5 fig., 5 ref.

Descriptors: *Methodology, *Oily water, *Sampling, *Water analysis, Water quality, Data collections, On-site data collections, On-site investigations, Testing procedures.
Identifiers: *Oil sampling, Thin film oil sampling, Oil identification, Marine pollution.

The U. S. Coast Guard is developing sampling systems for their oil films. Four prototypes have been developed and are being evaluated for handling characteristics, maintenance and repair, efficiency and ability to maintain the chemical integrity of the sample. (See also W76-10370) (Katz)
W76-10381

SAMPLING OF OIL SPILLS AND FINGERPRINTING BY INFRARED SPECTROSCOPY,
Rhode Island Univ., Kingston, Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W76-10383

MAPPING AND IDENTIFICATION OF OIL ON WATER BY THE USE OF AN AIRBORNE LASER SYSTEM,
National Aeronautics and Space Administration, Wallops Island, Va. Wallops Station.
For primary bibliographic entry see Field 5B.
W76-10384

SAMPLING ERRORS IN THE QUANTIFICATION OF PETROLEUM IN BOSTON HARBOR WATER,
Massachusetts Inst. of Technology, Cambridge. Dept. of Chemical Engineering.
A. M. Ahmed, M. D. Beasley, A. C. Efromson, and R. A. Hites.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974. p. 109-111, 3 tab, 10 ref.

Descriptors: *Oily water, *Analytical methods, Analysis, *Statistical methods, Methodology, On-the-site observations, Evaluation, Sampling, *Massachusetts.
Identifiers: Carbon tetrachloride extraction, Polyurethan foam adsorption, *Boston inner harbor(Mass), *Sampling errors, Infrared quantification, Marine pollution.

There are two major ways of reducing the large sampling error for petroleum in water. These are replication of samples and larger sample sizes. The measurement of most interest, however, is the thickness of the surface oil layer not the concentration of the dispersed oil below. (See also W76-10370) (Katz)
W76-10387

HYDROCARBON CONCENTRATIONS IN SEAWATER ALONG THE HALIFAX-BERMUDA SECTION: LESSONS LEARNED REGARDING SAMPLING AND SOME RESULTS,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
D. C. Gordon, Jr., and P. D. Keizer.
In: NBS Special Publication 409, Marine Pollution Monitoring, (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p 113-115, 2 tab., 3 ref.

Descriptors: *Oil pollution, *Fluorescence, *Spectroscopy, *Atlantic Ocean, Analysis, *Sampling, Oily water, Analytical techniques, Methodology, On-the-site observations, Statistical methods, Canada, Water sampling.
Identifiers: *Fluorescence spectroscopy, Aromatic hydrocarbons in sea water, Nova Scotia,

Halifax, Bermuda, Fluorescent material in sea water.

Petroleum hydrocarbon contamination in seawater along the Halifax-Bermuda section appears limited to the upper few meters. Most is contained in the surface film. The large standard deviation indicates that the distribution is quite spotty. (See also W76-10370) (Katz)
W76-10388

HYDROCARBON CONTENT AND CHLOROPHYLL CORRELATION IN THE WATERS BETWEEN NOVA SCOTIA AND THE GULF STREAM,
Bermuda Biological Station for Research, St. George's West.
For primary bibliographic entry see Field 5B.
W76-10389

DETERMINATION OF AROMATIC HYDROCARBONS IN SEA WATER USING AN ELECTROLYTIC STRIPPING CELL,
National Bureau of Standards, Washington, D.C., Inst. for Materials Research.
S. P. Wasik, and R. N. Boyd.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p 117-118, 2 fig.

Descriptors: *Oily water, Methodology, *Analytical techniques, Analysis, *Gases, *Waste identification, Oil pollution, Sampling, Hydrogen, Marine water, Chromatography, *Pollutant identification.
Identifiers: Aromatic hydrocarbons, Electrolytic stripping cell, Marine pollution.

This paper describes a head-space method for determining aromatic hydrocarbons in sea water. The hydrocarbons are stripped from sea water, under equilibrium conditions, by very small bubbles of hydrogen gas generated electrolytically from a gold electrode located at the bottom of a cylindrically shaped cell. The hydrocarbon concentration in the sea water is determined from the volume of the sea water and the hydrocarbon concentration in the head-space after a measured volume of hydrogen has bubbled through the stripping cell. (See also W76-10370) (Katz)
W76-10390

DETERMINATION OF AROMATIC AND TOTAL HYDROCARBON CONTENT IN SUBMICROGRAM AND MICROGRAM QUANTITIES IN AQUEOUS SYSTEMS BY MEANS OF HIGH PERFORMANCE LIQUID CHROMATOGRAPHY,
Bermuda Biological Station for Research, St. George's West.
A. Zsolnay.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p 119-120, 2 fig, 7 ref.

Descriptors: *Oily water, Methodology, *Analytical techniques, Analysis, *Waste identification, Oil pollution, Marine water, *Chromatography, *Pollutant identification.
Identifiers: Aromatic hydrocarbon analysis, Total hydrocarbon analysis, Liquid chromatography, Flow colorimeter, Marine pollution.

In order to determine the hydrocarbon concentration in small water samples rapidly and fairly simply, two separate but related methods were developed. Both are based upon the use of high performance liquid chromatography. They are more sensitive than the IR methods, which tend to have a maximum sensitivity of 0.05 mg, and they are probably more specific than UV or fluorescence methods used without column chromatography. Their main advantage over GLC lies in the fact that they are simpler and more rapid for the obtaining of quantitative results. (See also W76-10370) (Katz)
W76-10391

DETERMINATION OF C1-C10 HYDROCARBONS IN WATER,
Chevron Oil Field Research Co., La Habra, Calif.
C. D. McAuliffe.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p 121-125, 1 tab, 4 fig, 14 ref.

Descriptors: *Water pollution, Methodology, *Analytical techniques, Analysis, *Gas chromatography, Oily water, Oil pollution, Waste identification, Environment, *Pollutant identification.
Identifiers: Distribution coefficient, Environmental surveys, Equilibrium, Hydrocarbon types, Hydrocarbons in water.

Several fields require the measurement of widely varying concentrations of hydrocarbons dissolved in water. These fields include environmental studies, petroleum exploration, and biochemical research, among others. The method reported here is based on successive gas equilibrations of a hydrocarbon-free gas with an aqueous sample containing dissolved hydrocarbons. All classes of hydrocarbons having up to 11 carbon atoms in the molecule can be determined. (See also W76-10370) (Katz)
W76-10392

SUSPENSIONS OF CRUDE OILS IN SEA WATER: RAPID METHODS OF CHARACTERIZING LIGHT HYDROCARBON SOLUTES,
Battelle Pacific Northwest Labs., Richland, Wash. Ecosystems Dept.
R. M. Bean.
In: NBS, Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p 127-130, 1 tab, 4 fig, 12 ref.

Descriptors: *Oily water, *Oil pollution, Methodology, *Gas chromatography, *Waste identification, Analytical techniques, Analysis, Spectrophotometry, *Pollutant identification.
Identifiers: Crude oil, Suspensions, Insoluble oil, Filtration, Oil solutions, Infrared spectrophotometry.

The purpose of this study was to develop rapid means for analysis of dissolved light hydrocarbons with respect to hydrocarbon type, which would be suitable for characterization of bioassay treatment media and oil/water discharges of a similar nature. To accomplish this, it was necessary to develop methods for sampling at locations remote from analytical instrumentation, and for correlation of hydrocarbon composition with simple spectrophotometric methodology. A rapid gas chromatographic method was developed to determine the light hydrocarbon composition of oil/seawater systems. (See also W76-10370) (Katz)
W76-10393

MEASUREMENT AND CHARACTERIZATION OF NONVOLATILE HYDROCARBONS IN OCEAN WATER,
Exxon Research and Engineering Co., Linden, N. J.
For primary bibliographic entry see Field 5B.
W76-10394

IDENTIFICATION, ESTIMATION AND MONITORING OF PETROLEUM IN MARINE WATERS BY LUMINESCENCE METHODS,
Baird-Atomic, Inc., Bedford, Mass.
For primary bibliographic entry see Field 5B.
W76-10395

RECENT DEVELOPMENTS IN THE IDENTIFICATION OF ASPHALTS AND OTHER PETROLEUM PRODUCTS,
Environmental Protection Agency, Cincinnati, Ohio.
F. K. Kawahara.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974. p. 145-148, 1 tab., 5 fig., 6 ref.

Descriptors: *Asphalt, *Methodology, *Statistical analysis, Analytical Techniques, Waste identification, Oil pollution, Oily water, Oil spills, Infrared radiation, Industrial wastes, Gas chromatography, Pipelines, *Pollutant identification.
Identifiers: Discriminate function analysis, Infrared spectrophotometers.

This paper reports the successful application of electron capture detector gas chromatography to the analysis of the minor components present in asphalts and their utility to provide prima facie legal evidence, that is corroborated by other methods of identification. (See also W76-10370) (Katz)
W76-10396

IDENTIFICATION OF HYDROCARBONS IN AN EXTRACT FROM ESTUARINE WATER ACCOMODATED NO. 2 FUEL OIL,
Virginia Inst. of Marine Sciences, Gloucester Point. Environmental Chemistry Section.
R. H. Bieri, A. L. Walker, B. W. Lewis, G. Losser, and R. J. Huggett.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 149-153, 3 tab., 3 fig., 6 ref.

Descriptors: *Fossil fuels, *Oil wastes, *Gas chromatography, *Mass spectrometry, Analytical techniques, Methodology, Oily water, *Waste identification, Estuarine pollution, Oil spills, *Pollutant identification, Data processing.
Identifiers: *Fossil hydrocarbons, No. 2 Fuel oil, Specific compound identification, Naphthalene compounds, Indanes, Gas chromatograms, Biphenyls.

The application of the mass spectrometer with interfaced gas chromatography and data handling system to the identification of hydrocarbons in estuarine waters is described. (See also W76-10370) (Katz)
W76-10397

ANALYSES OF HYDROCARBONS IN MARINE ORGANISMS: RESULTS OF IDOE INTERCALIBRATION EXERCISES,
Woods Hole Oceanographic Institution, Mass.
J. W. Farrington, J. M. Teal, J. G. Quing, P. L. Parker, and J. K. Winters.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 163-166, 4 tab., 5 ref.

Descriptors: *Methodology, *Analytical techniques, *Oil wastes, *Oily waters, *Waste identification, *Organic compounds, Laboratory tests, Organic wastes, Chromatography, Oil pollution, *Calibration, Marine animals, *Pollutant identification.
Identifiers: Tuna, Tuna meal, N-alkanes.

The importance of intercalibration of hydrocarbon analyses between laboratories was recognized early in the program of baseline studies of the Office for the International Decade of Ocean Exploration, National Science Foundation. Three participating laboratories analyzed a cod liver sample spiked with a distillate cut of South Louisiana crude oil. Four participating laboratories analyzed a tuna meal sample provided as working intercalibration sample through the courtesy of the

National Bureau of Standards. The methods of analysis were not specified. Each laboratory analyzed the sample using the techniques and methods employed at that time in the respective laboratories. (See also W76-10370) (Katz)
W76-10398

IDOE-5 INTERCALIBRATION SAMPLE: RESULTS OF ANALYSIS AFTER SIXTEEN MONTHS STORAGE,
Woods Hole Oceanographic Institution, Mass. Dept. of Chemistry.
G. C. Medeiros, and J. W. Farrington.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 167-169, 1 tab., 1 fig., 3 ref.

Descriptors: *Methodology, *Marine fish, *Laboratory tests, *Waste identification, *Gas chromatography, *Analytical techniques, Oil pollution, Organic compounds, Oily wastes, Louisiana, *Calibration, *Pollutant identification.
Identifiers: Cod liver, South Louisiana crude, Cod liver lipid, Intercalibration, IDOE.

Participation is reported with two other laboratories in an intercalibration exercise using as a sample a cod liver lipid extract spiked with a distillate cut of South Louisiana crude oil. A subsample was stored separately and analyzed 16 months later. The original sample and the stored sample were in agreement. (See also W76-10370) (Katz)
W76-10399

USE OF LOW MOLECULAR-WEIGHT-HYDROCARBON CONCENTRATIONS AS INDICATORS OF MARINE POLLUTION,
Texas A and M Univ. College Station, Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W76-10400

SAMPLING MARINE ORGANISMS AND SEDIMENTS FOR HIGH PRECISION GAS CHROMATOGRAPHIC ANALYSIS OF AROMATIC HYDROCARBONS,
National Marine Fisheries Service, Auke Bay, Alaska. Auke Bay Fisheries Lab.
H. E. Bruce.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 181-182, 1 tab.

Descriptors: *Mollusks, *Mussels, *Crabs, *Monitoring, Marine organisms, Monitoring sediments, Pacific Ocean, *Alaska, Cold regions, Sediments, On-the-site investigations, Water quality, Oil poliution, Oily water, *Sampling, Chemical analysis.
Identifiers: *Prince William Sound(Alas), Macoma, Achmaea, Limpet, Cancer magister, Dungeness crab.

Sampling techniques for the collection of sediment samples and inner tidal organisms have been developed as part of a hydrocarbon baseline study in Prince William Sound of Alaska. Two species of clams, a limpet and the Dungeness crab will be analyzed for hydrocarbons. (See also W76-10370) (Katz)
W76-10401

FIELD SAMPLING METHODS AND TECHNIQUES FOR MARINE ORGANISMS AND SEDIMENTS,
University of Southern California, Los Angeles. Allan Hancock Foundation.
D. Straughan.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974. p. 183-187, 2 tab., 1 fig., 10 ref.

Descriptors: *Oil pollution, *Oily water, *Monitoring, Methodology, Sediments, On-the-site investigations, Water quality, Statistical analysis, Chemical analysis, Nets, *Sampling, Marine animals, Pollutant identification.
Identifiers: Coal oil point, Natural petroleum compounds, Animal tissues, Field sampling methods, Field sampling techniques.

Paper addresses itself to the difficulty in obtaining representative data to describe levels of petroleum content of sediments and organisms in an area. Most of the field sampling problems are the result of the uneven petroleum distribution in the marine environment. (See also W76-10370) (Katz)
W76-10402

METHODS FOR ESTABLISHING LEVELS OF PETROLEUM CONTAMINATION IN ORGANISMS AND SEDIMENT AS RELATED TO MARINE POLLUTION MONITORING,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
For primary bibliographic entry see Field 5B.
W76-10403

QUANTITATIVE DETERMINATION OF HYDROCARBONS IN MARINE ORGANISMS,
Battelle Columbus Labs., Ohio.
J. S. Warner.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974. p. 195-196, 1 tab., 2 fig.

Descriptors: *Oil pollution, *Oily waters, *Mollusks, *Clams, *Gas chromatography, *Oysters, *Spectrometry, *Analytical techniques, Marine animals, Pollutant identification.
Identifiers: Fuel oil, Aromatic hydrocarbons, Silica gel fractionation, Tissue extraction, *Marine pollution.

A description is presented for a reliable analytical methodology that is diagnosed for individual hydrocarbon components and applicable to the analysis of relatively large numbers of samples. (See also W76-10370) (Katz)
W76-10404

LONG TERM WEATHERING CHARACTERISTICS OF IRANIAN CRUDE OIL: THE WRECK OF THE 'NORTHERN GULF',
Bowdoin Coll., Brunswick, Maine. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W76-10405

ANALYTICAL TECHNIQUES FOR ISOLATING AND QUANTIFYING PETROLEUM PARAFFIN HYDROCARBONS IN MARINE ORGANISMS,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
R. C. Clark, Jr., and J. S. Finley.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 209-212, 2 tab., 4 fig., 6 ref.

Descriptors: *Oil pollution *Oil spills, *Analytical techniques, Gas chromatography, Pathology, Environmental effects, Waste identification, Mussels, Seaweed, Marine plants, Marine algae, Water analysis, Marine animals, *Bioindicators, Pollutant identification.
Identifiers: N-C16 Ratio, Paraffin hydrocarbon, Tissue analysis, Fucus, N-paraffin hydrocarbons.

Marine organisms can be used as indicators of petroleum pollution when it is possible to separate the biogenic paraffin hydrocarbons from pollution hydrocarbons. Once these paraffin hydrocarbon methods suggest petroleum contamination of a marine population, then other methods can be applied to delineate aromatic hydrocarbons and to establish the extent of the pollution in the marine environment. (See also W76-10370) (Katz)
W76-10406

DETERMINATION OF HYDROCARBONS IN MARINE ORGANISMS AND SEDIMENTS BY THIN LAYER CHROMATOGRAPHY,
California Univ., Berkeley. Naval Biomedical Research Lab.
L. Hunter, H. E. Guard, and L. H. DiSalvo.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974. p. 213-216, 1 tab., 2 fig., 6 ref.

Descriptors: *Oil pollution, *Analytical techniques, *Marine animals, *Mussels, *Sediments, *Benthic organisms, *Waste identification, Chromatography, California, Crabs, Clams, Monitoring, *Pollutant identification, Bays.
Identifiers: *San Francisco Bay, Sponge, Starfish, Scallop, Hydrocarbons, Hydrocarbon monitoring, San Francisco Bay hydrocarbons.

Research in the Naval Biomedical Research Laboratory investigates hydrocarbons in organisms as an integrative indicator of hydrocarbon insult in San Francisco Bay water. Surface sediments (0-6 cm) have been analyzed as a transient hydrocarbon storage compartment with a longer residence time than characteristic of organisms. (See also W76-10370) (Katz)
W76-10407

PELAGIC TAR IN THE GULF OF MEXICO AND CARIBBEAN SEA,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W76-10409

INTERLABORATORY QUALITY CONTROL STUDY NO. 5, CHROMIUM, IRON, MOLYBDENUM AND VANADIUM,
Canada Centre for Inland Waters, Burlington (Ontario).
R. W. Wales, and D. J. McGirr.
Canada Centre for Inland Waters, Report Series No. 26, 1973, 6 p, 5 ref, 6 tab.

Descriptors: *Chromium, *Iron, *Molybdenum, *Heavy metals, Water quality, Absorption, Trace elements, Solvent extractions, Chemical analysis, *Pollutant identification, Analytical techniques, Water analysis.
Identifiers: *Vanadium, Atomic absorption.

Samples containing known amounts of chromium, iron, molybdenum and vanadium were distributed to thirteen laboratories to be analyzed by the laboratories' usual methods. The majority of laboratories determined the metals by atomic absorption; in addition, iron was determined colorimetrically for comparison. Only a few participants were able to analyze all four metals, and in the case of molybdenum and vanadium the small number of results received made it difficult to come to firm conclusions about the reliability of the method. The precision for chromium was better than in a previous study. The results obtained for iron by atomic absorption with solvent extraction were good, while the colorimetric method was intermediate in precision and sensitivity between solvent extraction and direct aspiration using atomic absorption. (Environment Canada)
W76-10493

INTERLABORATORY QUALITY CONTROL STUDY NO. 4, ARSENIC, CADMIUM, COBALT, MERCURY AND NICKEL,
Canada Centre for Inland Waters, Burlington (Ontario).

D. J. McGirr, and R. W. Wales.
Canada Centre for Inland Waters, Report Series No. 25, 1973, 7 p., 7 ref., 6 tab.

Descriptors: *Trace metals, *Cadmium, *Cobalt, *Nickel, Water quality, *Mercury, *Chemical analysis, Industrial wastes, Toxins, *Pollutant identification, Water analysis, Analytical techniques, Arsenic compounds.
Identifiers: Atomic absorption, *Arsenic, Stock solutions, Inorganic mercury, Orgnic mercury.

Synthetic samples containing arsenic, cadmium, cobalt, nickel and mercury were analyzed by nine laboratories participating in a study of trace metals. Most laboratories used atomic absorption methods for determining cadmium, cobalt ad nickel; precision and accuracy were good for these three metals. Results were also acceptable for arsenic, which most laboratories determined by the silver diethyldithiocarbamate method. Both precision and accuracy were rather poor for mercury, which was analyzed by various procedures based on flameless atomic absorption; it is suggested that the laboratories review their procedures. (Environment Canada)
W76-10495

APPLICABILITY OF THE TECHNICON AUTOANALYZER I AND II SYSTEMS FOR SHIPBOARD ANALYSIS OF GREAT LAKES WATER SAMPLES,
Canada Centre for Inland Waters, Burlington (Ontario).
F. J. Philbert, O. Elkei, W. D. Blythe, and Y. M. Sheikh.
Water Quality Branch, Technical Bulletin No. 93, 1975, 10 p. 6 fig., 9 ref. 1 tab.

Descriptors: Ships, *Water sampling, *Water quality, Great Lakes, *Lake Ontario, *Lake Huron, Phosphates, Silica, Nitrites, Nitrogen, Nitrates, Phosphorus, Ammonia, Chlorides, Chemical analysis, Sampling, *Pollutant identification, Lakes.
Identifiers: Reactive silicas, Reagents.

Water samples from lakes Ontario and Huron were analyzed simultaneously, using the Technicon AutoAnalyzer 1 and 11 (AA1 and AA11) systems, for soluble reactive phosphate, soluble reactive silica, nitrate plus nitrite nitrogen, ammonia nitrogen, total alkalinity and chloride. The major instrumental features of the AA1 and AA11 systems are described and results are compared of sample analysis, standard deviations and percent recoveries for the methods used. Comparable analytical results were obtainable from the two systems for all of the parameters except ammonia. The results of sample analysis for ammonia by the AA1 method exceeded those obtained using the AA11 method by as much as 18%. Both systems gave satisfactory percent recoveries and the precisions compared reasonably well. (Environmental Canada)
W76-10497

5B. Sources Of Pollution

MUDS, SLIMES AND SLUDGES,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Mineral Chemistry.
For primary bibliographic entry see Field 5D.
W76-10008

A METHOD FOR ASSESSING FRICTION LOSSES FOR A NON-NEWTONIAN FLUID, SUCH AS SEWAGE SLUDGE, UNDER LAMINAR FLOW CONDITIONS,
Thames Water Authority, London (England) Metropolitan Public Health Div.
A. J. Selby.
The Public Health Engineer, Vol. 4, No. 2, p 44-48, March, 1976. 13 fig, 2 ref.

Descriptors: Hydraulics, *Flow rates, *Sewage sludge, *Mathematical models, *Friction, *Laminar flow, *Path of pollutants, Waste water treatment, Sludge treatment.

Sewage sludge behaves more like a Non-Newtonian fluid in which shear stress is some function of shear rate, than like a Newtonian fluid. The Generalized Bingham Plastic Equation, which considers the laminar region of Non-Newtonian flow, is used to construct a universal system. This system produces a continuous curve relating friction gradient to flow velocity. It is applied using straight-forward graphical means. To use the method, the relationship between shear stress and shear rate must be determined, requiring rheological testing of the sludge. The density of the sludge must also be determined. (Snyder-FIRL)
W76-10009

PREDICTING THE WATER POLLUTION POTENTIAL OF PROPOSED SANITARY LANDFILLS PART I: SANITARY LANDFILL LEACHATE...WHAT IT IS,
Indiana Univ., Indianapolis. School of Medicine.
W. A. Oleckno.
Journal of Environmental Health, Vol. 38, No. 5, p 331-333, March-April, 1976. 5 tab, 12 ref.

Descriptors: *Landfills, *Groundwater, *Water pollution sources, *Leachate, Anaerobic conditions, Hydrology, Forecasting, Biodegradation, Leaching, *Path of pollutants.

Sanitary landfill leachate creates a water pollution threat to nearby groundwater sources and streams, although the problem can feasibly be prevented by adequate landfill location. Stabilization of a landfill includes biological decay, chemical oxidation, diffusion of gases, movement of liquids, dissolving and leaching of materials, movement of dissolved material, and uneven settlement. The biological decay is usually predominantly anaerobic, although there are zones where oxygen is available and decay is aerobic. Leachate may contain any of the decomposition products, such as organic matter, metallic cations, anions, and dissolved gases. Carbon dioxide dissolved in the leachate may increase the acidity. Initial leachate production depends on the time of emplacement and moisture content, but subsequent generation is seasonal in response to climatic conditions. Leachate has been found 80 ft below a landfill. Variables causing differences in leachate from different landfills include the amount and composition of refuse, its sorting and degree of compaction, the characteristics and amount of water in contact with it, the duration of contact with the water, and temperature. The leachate may be relatively heavily contaminated. However, the leachate always changes with migration, and natural strata can attenuate groundwater contaminated with leachate as it moves away from the fill area. (See also W76-10014) (Snyder-FIRL)
W76-10013

PREDICTING THE WATER POLLUTION POTENTIAL OF PROPOSED SANITARY LANDFILLS PART II: AN INDEX OF THE WATER POLLUTION POTENTIAL OF SANITARY LANDFILLS,
Indiana Univ., Indianapolis. School of Medicine.
W. A. Oleckno.
Journal of Environmental Health, Vol. 38, No. 5, p 334-336, March-April, 1976. 2 ref.

Descriptors: *Leachate, *Landfills, *Waste disposal, *Soil mechanics, Flooding, Environmental engineering, Sanitary engineering, Forecasting, *Path of pollutants, Water pollution sources.

Many factors must be considered in selecting a site for a sanitary landfill. Although landfills may pose serious hazards, landfills can be planned and maintained that will not harm water quality. A numerical index indicating the water pollution potential of proposed sanitary landfills was developed, with point values assigned to various gradations of the criteria. The criteria were precipitation, soil type between the landfill bottom and the maximum water table, and distance between the landfill bottom and the maximum water table. The index does not replace a detailed survey. Because leachate flows slowly through slightly permeable strata, attenuation has a greater chance to occur. Due to possible fractures where channeling might occur, shale, dolomite, and limestone were assigned the same point value as gravel. Since flooding may rapidly bring refuse cells to field capacity and produce large volumes of leachate, the flooding frequency should be once in 50 yr or less. If a site is considered satisfactory by the index, surface water over 200 ft away from it probably will not be contaminated. The index indicates that, all other factors being identical, a site over clayey silt 6 ft above the maximum water table is preferable to a site over 5 ft of fine sand over fractured sandstone with a maximum water table at 15 ft. Even fills found satisfactory should be investigated further to ensure that the data used was fully representative of the site. A site with one satisfactory portion may not be satisfactory 20 ft away, due to a shift in underlying rock or soil conditions. After the site is developed monitoring wells should be drilled and nearby streams sampled periodically to insure that water pollution by leachate is not occurring. (See also W76-10013) (Snyder-FIRL)
W76-10014

PHOSPHORUS DISTRIBUTION FROM SEPTIC TANK EFFLUENT IN COASTAL PLAIN SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
R. B. Reneau, Jr., and D. E. Pettry.
Journal of Environmental Quality, Vol. 5, No. 1, p 34-39, January-March, 1976. 5 tab, 25 ref.

Descriptors: *Septic tanks, *Phosphorus, *Monitoring, *Water pollution sources, Groundwater, Soil analysis, Soil water movement, Effluents, *Path of pollutants, Pollutant identification.

Phosphorus accumulations in Goldsboro and Varina sandy loams, both of whose water tables are high perched, were monitored to study the fate of phosphorus from septic effluent. Lateral and vertical phosphorus movements were determined with piezometers at selected depths and distances from the drainfield. Orthophosphate in the perched water tables decreased from 5.5 micrograms/ml in undiluted effluent to 0.32 micrograms/ml in Varina soil at 3.0 m distance and from 11.8 micrograms/ml to less than 0.20 micrograms/ml in Goldsboro soil at 3.0 m distance. Little orthophosphate was present in either soil at 12 m distance. The possibility of vertical movement contaminating permanent groundwater tables is limited, because the slowly permeable horizons were effective barriers to vertical orthophosphate movement. Phosphorus was concentrated at depths from 142 to 152 cm in the Goldsboro loam. The septic effluent did not appreciably alter fixed phosphorus quantities of phosphorus fraction distributions in the Goldsboro loam or farther than 3 m from the system in the Varina soil. Soil phosphorus fractions near the drainfield were present mainly as ammonium fluoride and sodium hydroxide extractable phosphorus and organic phosphorus. In the Varina loam, the ammonium fluoride extractable phosphorus fraction increased from 2 to 4 micrograms/g in the control profile to as much as 460 micrograms/g, and the sodium hydroxide extractable phosphorus fraction from between 40 and 50 micrograms/g to as high as 425 micrograms/g, at 0.15 m in the argillic horizons. (Snyder-FIRL)
W76-10015

POLLUTION OF GROUNDWATER BY LANDFILLS (POLLUTION DE L'EAU SOUTERRAINE PAR LES DECHARGES),
G. Matthess.

Techniques et Sciences Municipales--L'Eau, No. 2, p 67-75, 1976, 18 ref.

Descriptors: *Groundwater, *Landfills, *Water pollution control, Hydrological aspects, Flow rates, Water pollution sources, Waste disposal.

The possibilities for minimizing hazards of groundwater pollution, as related to choice of landfill site, are discussed. Some hydrogeological conditions are mentioned in which local groundwater pollution can be tolerated to avoid other environmental hazards. In hydrogeological conditions unfavorable to landfill siting, such as karst, heavily fractured rock, and aquifers, where the porosity allows for a high flow rate, landfills should be authorized only where widespread pollution of groundwater is prevented. (Kramer-FIRL)
W76-10016

A SIMULATION OF WATER POLLUTION MODEL PARAMETER ESTIMATION,
National Aeronautics and Space Administration, Langley Station, Va. Langley Research Center.
J. F. Kibler.
In: Proceedings of the 22nd Annual Technical Meeting of the Institute of Environmental Sciences, April 26-28, 1976, Philadelphia, Pennsylvania, p 533-537. 5 ref.

Descriptors: *Pollutant identification, *Path of pollutants, *Model studies, Water pollution, Mathematical models, Computer models, *Simulation analysis.
Identifiers: *Pollution transport models.

The parameter estimation procedure for a water pollution transport model was developed using simulated data. A two-dimensional instantaneous-release, shear-diffusion model was selected to represent a simple transport process. It was used with a remote sensor model which connected it with an inertial coordinate system. Data from a remote sensor was simulated by values generated by the transport model, with gaussian noise added. A least -squares batch processor used this data to estimate model parameters, providing a means to evaluate sensor characteristics. The most accurate estimates for all parameters could be produced by variable resolution, but variable resolution would increase sensor or data acquisition costs. Data acquisition strategy distinctly affects estimate accuracy. Imaging strategy can be specially designed for accurate estimates of one or two parameters of interest. All parameters can be estimated accurately by multiple data passes. Data acquisition costs can be reduced by using a limited number of carefully placed images, which can yield nearly the accuracy of many more data points. (Snyder-FIRL)
W76-10021

COMPUTER-AIDED MODELLING OF STREAM PURIFICATION CAPACITY, PART I: NON-LINEAR DO MODEL,
Rensselaer Polytechnic Inst., Troy, N. Y.
L. K. Wang, D. Vielkind, and M. H. Wang.
In: Proceedings of the 22nd Annual Technical Meeting of the Institute of Environmental Sciences, April 26-28, 1976, Philadelphia, Pennsylvania, p 553-557. 2 fig, 2 tab, 15 ref.

Descriptors: *Waste assimilative capacity, *Dissolved oxygen, *Self-purification, Rivers, *Waste water disposal, Biodegradation, Model studies, Mathematical models, Reaeration, Streams, Biochemical oxygen demand, *Path of pollutants, *Computer models.

When non-toxic, biodegradable plant effluent with low nutrient content is released into a stream, the dissolved oxygen (DO) content initially decreases due to the high biochemical oxygen demand (BOD), then increases as the atmospheric aeration rate becomes greater than the BOD, until the normal cycle is reestablished. This process is known as self-purification. Oxygen is needed for the reactions which convert organic substances to carbon dioxide, water, phosphate, sulfate, nitrite, and nitrate. For this reason, a stream is capable of self-purification only if its water contains sufficient DO and necessary microorganisms. The minimum DO concentration is different in different types of streams. Equations exist for calculating the time until the minimum DO content is reached, the DO deficit at that point, the distance to the location where the minimum occurs, and the initial DO deficit. The DO saturation concentration must be known in order to calculate this last quantity. The DO concentration at the critical location must be at least the minimum DO concentration established by governmental standards. A new mathematical model was developed for the DO saturation concentration. A computer was used to compare data with linear, quadradic, and cubic functions of temperature. A cubic function produced the best fit. It was accurate to plus or minus 0.01 mg/liter DO, while a previous model was only accurate to plus or minus 0.1 mg/liter. Results from the model can be used, in turn, to determine DO deficits, the critical DO concentration, and the DO drop that can be allowed in a stream receiving waste water. (See also W76-10025) (Snyder-FIRL)
W76-10024

COMPUTER-AIDED MODELLING OF STREAM PURIFICATION CAPACITY, PART II: MULTIPLE LINEAR CORRELATION METHOD,
Rensselaer Polytechnic Inst., Troy, N. Y.
L. K. Wang, M. H. Wang, and D. Vielkind.
In: Proceedings of the 22nd Annual Technical Meeting of the Institute of Environmental Sciences, April 26-28, 1976, Philadelphia, Pennsylvania, p 558-564. 1 fig, 2 tab, 9 Ref.

Descriptors: *Waste assimilative capacity, *Dissolved oxygen, *Self-purification, Streams, Rivers, Reaeration, Waste water disposal, Biodegradation, Model studies, Mathematical models, Biochemical oxygen demand, *Path of pollutants, *Computer models, *Correlation analysis.

A FORTRAN computer program can derive two mathematical models for the mechanism of dissolved oxygen exchange by natural waters. The quantities modeled are dissolved oxygen (DO) drop and biochemical oxygen demand (BOD) at the DO sag in a stream. The multiple linear correlation method was previously used to model these quantities. A generally good correlation was demonstrated between DO, BOD, stream water temperature, and stream flow. A computer must be used, however, to develop these models for a specific stream. As an example, these models were developed for a stream which had been studied previously without the computer program. A plant discharged effluent into a small creek which then flowed into the main stream. Data were collected on four days with varying flow conditions. Sampling was performed on the creek both upstream and downstream of the discharge and on the main stream above, at, and below the confluence with the small creek. Data on upstream BOD, stream water temperature, stream flow, and BOD at the stream's sag point were used to obtain the specific models for DO drop and BOD. The observed DO drop at the sag point was predicted very precisely by the specific model. The BOD model showed acceptable accuracy in predicting the loads observed at the sag point. (See also W76-10024) (Snyder-FIRL)
W76-10025

INDUSTRIAL RESEARCH INSTITUTE STUDYING POLLUTION PROBLEMS OF SETO INLAND SEA,
Chugoku National Industrial Research Inst., Hiroshima (Japan).
T. Fukuda, and N. Hayakawa.
Civil Engineering in Japan, Vol. 14, p 143-149, 1975. 3 fig.

Descriptors: *Water quality, *Model studies, *Water pollution effects, *Mathematical models, Rivers, Photography, Water pollution control, *Computer models.
Identifiers: *Japan(Inland Sea).

A scale model was built of the Inland Sea, a shallow, narrow body of water surrounded by three major Japanese islands, to study methods of reducing further water quality deterioration. Its scale ratio is one to 2,000 in the horizontal and one to 160 in the vertical. Tides are reproduced with recirculating pumps and oscillating weirs and measured by up to 40 gauges. A computer is available to aid in the simulation and record the measurements. Over 70 rivers discharging regulated flow of dye solution are included in the model. Water samples can be extracted from any part of the model without disturbing the flow. An ultrasonic current meter measures flow velocity. Cameras are mounted above the model, and can be used to photograph floats. A study of dissolved oil diffusion with this model accurately predicted the results of an incident in which an oil refinery tank burst. Tidal flow in the inland sea is being measured for verification of the model. A more generalized density current basin and an alternating flow channel are used for more fundamental study. Mathematical computer models of tidal flow and diffusion in the Inland Sea are also being developed. (Snyder-FIRL)
W76-10031

INTERPRETATION OF INTERNAL TRACER EXPERIMENTS AND LOCAL SOJOURN TIME DISTRIBUTIONS,
City Coll., New York. Dept. of Chemical Engineering.
Y. Zvirin, and R. Shinnar.
International Journal of Multiphase Flow, Vol. 2, No. 5 and 6, p 495-520, April, 1976. 11 fig, 2 tab, 29 ref.

Descriptors: *Tracers, *Flow system, *Flow characteristics, Analytical techniques, Tracking techniques, Measurement, Water pollution, Hydrology, Hydrologic properties, Dispersion, Flow, Mixing, Path of pollutants.
Identifiers: Transport processes, Peclet number.

A general approach for the interpretation of tracer experiments designed to study transport processes in flow systems with multiple inlets and outlets is described. A method for the description of these processes is suggested based on the definition of such local model-free parameters as the purging rate, mixing rate, equivalent Peclet number and local sojurn time distributions. These parameters can be determined directly from tracer measurements without resorting to any model. Their values and especially their spatial distributions in the system describe the nature of the mixing and purging (or flushing) processes in the system. Experiments are described in which tracer material is introduced at given points within the system followed by measurements of the resulting concentration histories at the same points as well as at different sites. The results are pertinent to a variety of areas in which tracer experiments are used, including water physiology, hydrology, and the study of dispersion processes in the oceans. (Kreager-FIRL)
W76-10039

BIOLOGICAL SURVEY OF THE SAVANNAH RIVER IN THE VICINITY OF THE SAVANNAH RIVER PROJECT. PART I - REPORT ON THE WORK DONE AND TENTATIVE CONCLUSIONS ON THE SUMMER SURVEY,
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
For primary bibliographic entry see Field 5C.
W76-10041

BIOLOGICAL SURVEY OF THE SAVANNAH RIVER IN THE VICINITY OF THE SAVANNAH RIVER PROJECT, PART II - REPORT ON WORK DONE AND TENTATIVE CONCLUSIONS ON THE FALL SURVEY,
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
For primary bibliographic entry see Field 5C.
W76-10042

BIOLOGICAL SURVEY OF THE SAVANNAH RIVER IN THE VICINITY OF THE SAVANNAH RIVER PROJECT. PART III - REPORT ON THE WORK DONE AND TENTATIVE CONCLUSIONS ON THE WINTER SURVEY,
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
For primary bibliographic entry see Field 5C.
W76-10043

SAVANNAH RIVER BIOLOGICAL SURVEY, SOUTH CAROLINA AND GEORGIA, AUGUST, 1954.
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
For primary bibliographic entry see Field 5C.
W76-10044

CHEMICAL IMPACT OF SNOW DUMPING PRACTICES,
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5C.
W76-10049

AN ANALYSIS OF THE DYNAMICS OF DDT AND ITS DERIVATIVES, DDD AND DDE, IN MARINE SEDIMENTS
Stanford Univ., Pacific Grove, Calif. Hopkins Marine Station.
For primary bibliographic entry see Field 5C.
W76-10050

TIDALLY-PRODUCED INTERNAL BANDS ON THE SHELL OF ELMINIUS MODESTUS,
Natural Environment Research Council, Angelsey (Wales). Unit of Marine Invertebrate Biology; and University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 5A.
W76-10065

PETROLEUM HYDROCARBONS: DEGRADATION AND GROWTH POTENTIAL FOR ATLANTIC OCEAN SEDIMENT BACTERIA,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W76-10068

EFFECTS OF KRAFT MILL EFFLUENTS ON BENTHIC MACROPHYTE ASSEMBLAGES IN A SHALLOW-BAY SYSTEM (APALACHEE BAY, NORTH FLORIDA, U.S.A.),
Florida State Univ., Tallahassee. Dept. of Biological Science.
For primary bibliographic entry see Field 5C.
W76-10077

GROUND-WATER POLLUTION PROBLEMS IN THE NORTHWESTERN UNITED STATES,
Robert S. Kerr Environmental Research Lab., Ada, Okla.
F. Van der Leeden, L. A. Cerrillo, and D. W. Miller.
Research Reporting Series, EPA-660/3-75-018, 1975, 361 p, 60 fig, 48 tab, 459 ref, 3 append.

Descriptors: *Water pollution, *Groundwater, Colorada, Idaho, Montana, Oregon, Washington, Wyoming, Salinity, Hardness(Water), Chemical properties, Septic tanks, Sewage treatment, Irrigation water, Return flow, Dry farming, Oil wells, Impoundments, Mine drainage, Landfills, Radioactive waste disposal, *Pacific Northwest U. S.
Identifiers: Future water requirements, Groundwater evaluation.

Ground-water contamination problems have been investigated in six, northwest states: Colorado, Idaho, Montana, Oregon, Washington and Wyoming. Ground water represents 12 percent of the total water utilized in the region. Industrial and agricultural growth and development of new energy sources will cause a sharp increase in groundwater use over the next 30 years. Groundwater quality varies widely throughout the region. The most common problems are salinity, excessive hardness, iron, manganese and flouride. The principle sources of man-caused ground-water quality problems are: Septic tank sewage treatment plant discharges, irrigation return flow, dryland farming, abandoned oil wells, shallow disposal wells, unlined surface impoundments, mine tailings and drainage, municipal and industrial landfills, and radioactive waste disposal. The findings of the investigation were that with the exception of radioactive waste disposal, few cases of groundwater pollution have been examined in detail. A need exists for baseline water-quality data and systematic eavaluation of overall ground-water conditions; especially in urban zones, areas of petroleum exploration and development, and at locations of mining and industrial activity. (Heiss-NWWA)
W76-10083

GUARDIANS OF GROUND WATER QUALITY,
National Water Well Association, Worthington, Ohio.
For primary bibliographic entry see Field 5G.
W76-10096

POLLUTION EFFECTS ON SURFACE WATERS AND GROUND WATERS, (LITERATURE REVIEW),
Ontario Ministry of the Environment (Toronto).
For primary bibliographic entry see Field 5C.
W76-10104

AN ENVIRONMENTAL ASSESSMENT OF IMPACTS OF COAL DEVELOPMENT ON THE WATER SOURCES OF THE YAMPA RIVER BASIN, COLORADO AND WYOMING--PHASE-1 WORK PLAN,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 4C.
W76-10135

EFFECTS OF A LANDFILL ON GROUNDWATER QUALITY,
Geological Survey, Tallahassee, Fla.
D. H. Boggess.
Open-file report 75-594, 1975. 39 p, 8 fig, 2 tab, 9 ref.

Descriptors: *Water pollution sources, *Groundwater, *Landfills, *Waste disposal, *Path of pollutants, Data collections, Water wells, Sampling, Chemical analysis, Sulfates, Potassium, Ammonia, Nitrogen, Sodium, Chlorides, Evaluation, *Florida.
Identifiers: *Fort Myers(Fla).

Recognizing the potential problem of contamination of groundwater supplies by a landfill operated by Fort Myers, Fla., city officials requested that an investigation be made by the U. S. Geological Survey. Chemical analyses of water from 11 wells were adequate to show definite effects on groundwater quality in the vicinity of the landfill site. These effects were observed as far as 1,200 ft down gradient. When compared to the average concentrations of chemical constituents determined in comparable wells used as controls, water from the well with the greatest effect had sulfate 72 times greater, potassium 43 times greater, ammonia nitrogen 20 times greater, sodium and chloride 12 times greater, and most other chemical constituents 2 to 8 times greater. The results are expected to be of considerable value in the future selection of landfill sites, as well as to provide information on problems associated with existing sites which may be useful in determining more effective methods of operation. (Woodard-USGS)
W76-10137

DIFFUSION AND MASS FLOW OF NITRATE-NITROGEN TO PLANT ROOTS,
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W76-10182

CHARACTERISTICS OF THE ACCUMULATION OF FREE AMINO ACIDS BY SOME NONSPORULATING BACTERIA FROM TYPICAL IRRIGATED SIEROZEM, (IN RUSSIAN),
Akademiya Nauk Uzbekskoi SSR, Tashkent. Dept. of Microbiology.
V. V. Lazareva.
Uzb Biol Zh. 18(1), p 55-56, 1974.

Descriptors: *Bacteria, *Amino acids, *Sierozems, Irrigated land, Biomass, Cultivation, Isolation.
Identifiers: Achromobacter-Agile, Achromobacter-Agile-Var-Hartlebii, Achromobacter-Liquefacien-Var-Dendr, Amino-Acids.

A study of nonsporulating bacterial cultures isolated from typical irrigated sierozem soils of the Uzbek SSR revealed a large number of producers of glutamic acid, Bacterium agile 745, B. agile var. hartlebii 1071, Bacterium liquefaciens var. dendriticum 353. Accumulation of amino acids and biomass in the culture liquid of nonsporulating producers begins on the 2nd day and reaches a maximum by the 96-120 h of cultivation.--Copyright 1975, Biological Abstracts, Inc.
W76-10188

MODELS FOR EVALUATION OF HAZARDOUS WASTES,
Municipal Environmental Research Lab., Cincinnati, Ohio.
A. J. Klee.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 102, No. EE1, p 111-125, February 1976. 8 tab, 15 equ, 14 ref.

Descriptors: *Wastes, *Streams, *Environmental engineering, *Decision making, Materials, Hazards, Water pollution sources, Model studies, Equations, Systems analysis, Path of pollutants.
Identifiers: *Utility theory, Rating models, *Hazardous wastes, *Hazardous materials.

The problems encountered in the development of models for the quantification of the degree of hazard to the environment of waste streams are examined. With the aid of a numerical example, an additive utility approach is elucidated in detail. Three recently proposed hazardous waste rating models are also critically reviewed. In general, the complexities involved and the assumptions implied in the selection and implementation of such models are not recognized. Further, when applied to a sample of hazardous materials, there is inadequate agreement among these rating models. (Bell-Cornell)
W76-10190

LARGE-SCALE ESTUARINE WATER QUALITY MATRIX MODEL,
Texas Univ. at Austin. Dept. of Electrical Engineering.

B. R. Penumalli, R. H. Flake, and E. G. Fruh.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 102, No. EE1, p 191-209, February 1976. 8 fig, 5 tab, 19 equ, 2 ref.

Descriptors: *Water quality, *Estuaries, *Mathematical models, *Environmental engineering, Algorithms, Management, Numerical analysis, Phosphorus, Optimization, Data collections, Computers, Equations, Systems analysis, *Texas, Path of pollutants.
Identifiers: *Matrices(Mathematics), Transport process, Steady-state model, Linear matrix equation, Linear algebraic constraints, *Corpus Christi Bay(Tex).

A new mathematical modeling approach for predicting the concentrations of water quality constituents in an estuary has been developed. The model foundation is a two-dimensional partial differential equation describing the transport process in the estuary. The discretized version of a steady-state model is reformulated as a large dimensional linear matrix equation whose solution is obtained by an efficient iterative procedure. An analytical criterion for calibration is considered and the agreement of the matrix model solution with field data is examined. The model is calibrated with data for total phosphorus collected in two periods in the fall of 1972 from 18 sampling stations in Corpus Christi Bay. Numerical analysis of the matrix model is presented and its performance is compared with another phosphorus model for the Corpus Christi Bay system. This approach provides a simple structure for the model that is ideally suited to water quality management analysis and cost optimization. (Bell-Cornell)
W76-10191

THE INFLUENCE OF THE SURFACE RUNOFF OF HEAVY RAINS ON THE CALCULATION OF SEWERS (UBER DEN EINFLUSS DES FLACHENABFLUSSES DER STARKREGEN AUF DIE BERECHUNG VON KANALISATIONEN),
For primary bibliographic entry see Field 5D.
W76-10197

THE EFFECT OF VARIOUS DESIGNS OF RAIN CATCHING BASINS ON THE POLLUTION OF THE RECEIVING WATER AND THE ECONOMY OF THE SEWER SYSTEM (DIE AUSWIRKUNG DER VERSCHIEDENEN BAUARTEN VON REGENUBERLAUFBECKEN AUF DIE SCHMUTZBELASTUNG DES VORFLUTERS UND DIE WIRTSCHAFTLICHKEIT DES KANALNETZES),
Stuttgart Univ. (West Germany). Institut fuer Siedlungswasserbau und Wasserguetewirtschaft.
For primary bibliographic entry see Field 5D.
W76-10198

DISPOSAL OF SEWAGE FROM COASTAL TOWNS: THE CASE FOR SEA OUTFALLS,
Taylor (John) and Sons, London (England).
For primary bibliographic entry see Field 5E.
W76-10224

PERCOLATION TESTS FOR SEPTIC TANK SUITABILITY IN SOUTHERN ARIZONA SOILS,
Arizona Univ., Tuscon. Dept of Soils, Water, and Engineering.
For primary bibliographic entry see Field 5D.
W76-10248

THE FATE OF POLLUTANTS IN SUBSURFACE ENVIRONMENTS,
Weston (Roy F.), Inc., West Chester, Pa.
A. A. Metry.
In: Proceedings, 22nd Annual Technical Meeting of the Institute of Environmental Sciences, April, 1976, Philadelphia, Pennsylvania, p 1-5. 8 fig.

Descriptors: *Subsurface waters, *Aquifers, *Aquifer management, *Mathematical models, *Groundwater, *Waste disposal, Hydrogeology, Hydrologic data, Computer programs, Model studies, Mathematical models.
Identifiers: Land application.

Degradation of subsurface water quality is widespread. Examples of the pollution of groundwater due to improper land disposal are cited. Subsurface water can also be polluted by waste water seepage, deep well injection, and leachates from hazardous solid wastes. The threat to subsurface water in a given area is indicated by its hydrogeologic parameters, which should be important in planning storage and disposal sites. Mathematical models are developed to predict the migration and fate of leachate and pollutants in subsurface environments. A one-dimensional mathematical model was developed for attenuation of pollutants in subsaturated soils. Several mathematical models are developed for the migration of pollutants from a disposal site into aquifers; all include molecular diffusion, convective dispersion, and chemical reaction. A computer program simulating pollutant fate in aquifers was developed, incorporating the output of the subsaturated soils model and predicting concentrations of pollutants at various points in the aquifer. The models are flexible and practical, and account for the major mass transport mechanisms. They can be used in disposal site selection, evaluation of environmental impact, and recovery of groundwater contaminants. Their accuracy depends on that of the hydrogeologic parameters used in the simulation. (Snyder-FIRL)
W76-10253

MICROBIOLOGY AND CHEMISTRY STUDIES OF WATER QUALITY FACTORS IN A WATERSHED USED FOR MUNICIPAL SUPPLY AND WASTE DISPOSAL,
Montana State Univ., Bozeman. Dept. of Botany and Microbiology.
J. Schillinger, and D. Stuart.
Available from the National Technical Information Service, Springfield, Va., 22161, as PB-255 185, $6.00 in paper copy, $2.25 in microfiche. Research Report No. 74, Montana University Joint Water Resources Research Center, Bozeman, March 1976. 124 p, 71 fig, 5 tab, 47 ref. OWRT B-040-MONT(3).

Descriptors: *Water quality, *Land use, *Microbiology, *Chemistry, Water supply, Watersheds(Basins), Waste disposal, *Montana, Municipal water, Clear cutting, Grazing, Bioindicators.
Identifiers: East Gallatin River(Mont), Non-point pollution.

Chemical and bacteriological studies were performed to determine relative impacts of several land uses on water quality. Outdoor recreation, camping, and a winter ski development demonstrated no measurable adverse affect on quality. Clearcut logging with the use of streamside buffer zones resulted in little change in stream quality in the South Fork of Bozeman Creek. Wild animals appeared to cause bacterial contamination in the Bozeman Creek municipal watershed. Cattle grazing also resulted in some bacteriological stream quality degradation in several tributaries of the Hyalite drainage. Further research is required to assess adequately the public health significance of the bacterial levels observed. Agricultural runoff caused increased levels of chemical nutrient and indicator bacteria in the lower reaches of Bridger Creek, Hyalite Creek, and in the East Gallatin River. It appears that better streamside land-use practices could alleviate these adverse water quality impacts. (Holje-Montana State)
W76-10263

BORON AND ARSENIC STUDIES IN FLORIDA WATERS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
N. E. Carriker, W. T. Gillespie, and P. L. Brezonik.
Available from the National Technical Information Service, Springfield, Va., 22161, as PB-255 182, $5.50 in paper copy, $2.25 in microfiche. Florida Water Resources Research Center, Gainesville, Publication No. 34, May 1976. 100 p, 35 fig, 22 tab, 89 ref. OWRT A-024-FLA(1). 14-31-0001-5009.

Descriptors: *Arsenic, *Boron, *Toxicants, *Pollution sources, Water pollution, *Florida, Nutrients, Detergents, Toxicity, Phytotoxicity, Lakes, Sediments.
Identifiers: Lake Apopka(Fla).

Levels of arsenic and boron in Florida natural waters have been measured and found generally to be low and not of toxic concern. Boron levels in municipal sewage effluent are high enough to cause phytotoxicity, at least to sensitive plant such as citrus. The source of the elevated boron levels in sewage evidently is detergent use of borates as softeners and perborates as bleaching agents. Analysis of boron in rainfall found increasing concentrations near the coasts, indicating marine-derived aerosols are an important source of boron in the natural cycle of boron in Florida. Boron is a relatively conservative substance and model ecosystem studies indicate little toxic hazard and little bioaccumulation at the boron levels expected in natural waters. Arsenic levels in Florida surface and ground waters were found to be normally quite low (a few ppb) to undetectable (less than 1 ppb). Canals in South Florida around Lake Okeechobee had higher levels than other parts of the state, with detectable levels in almost all samples and a mean of 5 ppb. The arsenic cycle in aquatic systems appears to be sediment dominated. In citrus grove soils arsenic was associated mainly with the iron fraction, but in anaerobic Lake Apopka sediments, arsenic was present primarily in a leachable 'water soluble' form and was present as As III. Catfish from Lake Apopka do not appear to concentrate arsenic, but waterhyacinths from Lake Apopka had about 1 ppm (dry wt). (Morgan-Florida)
W76-10265

MINERAL CYCLING IN SOUTHEASTERN ECOSYSTEMS.
Savannah River Ecology Lab., Aiken, S.C.
For primary bibliographic entry see Field 5C.
W76-10266

A PRELIMINARY COMPARTMENT MODEL OF THE NITROGEN CYCLE IN A DECIDUOUS FOREST ECOSYSTEM,
Idaho Univ., Moscow. College of Forestry, Wildlife and Range Sciences.
J. E. Mitchell, J. B. Waide, and R. L. Todd.
In: Proceedings of a symposium 'Mineral Cycling in SOutheastern Ecosystems,' 1975, p 41-57. 2 fig, 5 tab, 40 ref, (CONF-740513).

Descriptors: *Ecosystems, *Cycling nutrients, *Nitrogen cycle, *Deciduous forests, Model studies, Forest soils, Organic matter, Vegetation, Litter, Bacteria, Fungi, Root zones, Temperate, North Carolina.
Identifiers: Nitrogen conservation, Franklin(NC), Coweeta Watershed(NC).

A 15-compartment model of nitrogen storage and transfer in a mature hardwood forest at the Coweeta Hydrologic Laboratory, near Franklin, North Carolina, is described and discussed. Most of the nitrogen in this ecosystem is located in large storage compartments that turn over slowly. Over 80% of the total nitrogen is in soil organic matter, with about 11% in vegetation, 3% in litter, 4% in microbes, and 2% in free soil pools. Uptake of

nitrogen is estimated to be 141.6 kg/ha/yr, of which about 10% is retained within the vegetation. A quantitatively large pool of nitrogen is shown to recycle annually within plants, a strategy which contributes to nitrogen conservation. Calculations suggest that litter inputs to soil organic pools are dominated by belowground material, especially small roots and mycorrhizae. In the soil available nitrogen seems to be rapidly immobilized by soil biota or taken up by the root-mycorrhizae complex, with very little nitrogen being lost from the system in stream water or denitrification. The study illustrates a dynamic cycle in which nitrogen is efficiently retained and recycled within the ecosystem. The gap in information on the root zone processes is stressed. (See also W76-10266) (Auen-Wisconsin)
W76-10269

SIMULATION OF NITROGEN DISTRIBUTION AND ITS EFFECT ON PRODUCTIVITY IN EVEN-AGED LOBLOLLY PINE PLANTATIONS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Theoretical Production Ecology.
Penning F. W. T. De Vries, C. E. Murphy, C. G. Wells, and J. R. Jorgensen.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, p 70-83. 6 fig, 1 tab, 15 ref, (CONF-740513). NSF AG-199, BMS 69-01147-A09.

Descriptors: *Nitrogen cycle, *Loblolly pine trees, *Model studies, Coniferous trees, Forest management, Nutrient requirements, Productivity, North Carolina, Computer programs, Southeast US, Nitrogen, Distribution.
Identifiers: Pine plantations.

A model describes growth in even-aged loblolly pine plantations from seedling to mature trees on sites where nitrogen availability is limiting, where the number of trees and shrubs in the understory is kept low, and managed with a 25- or 40-year rotation. The rate of decomposition and nitrogen release of the forest floor is simulated by treating 20-year classes of litter by the amount of biomass and nitrogen. Decomposition rates are calculated from the ratio of total carbon and nitrogen per layer, rather than treating needles and branches separately, and exclude the effects of temperature and humidity on decomposition. Trees were subdivided into roots, stem wood, stem bark, branches, and first- and second-year needles, with total dry weight and nitrogen content simulated for each of these fractions. The limiting effect of nitrogen is on assimilation on an annual basis rather than on growth. The model describes the physiological, microbiological, and mechanical processes relevant to nitrogen distribution and forest growth by a computer program in Continuous Simulations Modeling Program language. The program integrates the rates of change over one year and reports resulting amounts of nitrogen and biomass in the various parts of the system. Sudden modifications of distribution caused by cultural practices are taken into account. (See also W76-10266) (Auen-Wisconsin)
W76-10271

FREQUENCY DISTRIBUTIONS OF RADIOCESIUM CONCENTRATIONS IN SOIL AND BIOTA,
Savannah River Ecology Lab., Aiken, S.C.
J. E. Pinder, and M. H. Smith.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, p 107-126. 2 fig, 1 tab, 44 ref, 2 append, (CONF-740513). AEC AT (38-1)-310, AT(38-1)-708, AT(38-1)-819.

Descriptors: *Distribution patterns, *Radioisotopes, *Frequency analysis, *Mathematical models, Cesium, *Soils, *Biota, Rating curves.

Mathematical modeling to analyze and compare frequency distributions of radionuclide concentrations (primarily C-137) in various components of ecosystems at the Atomic Energy Commission's Savannah River Plant near Aiken, S.C. is discussed. The approach used was to evaluate four simple distributions--normal, log normal, exponential, and Weibull--as possible models of observed frequency distribution of radiocesium concentrations. The normal and exponential distributions showed closest agreement to relatively few sample distributions. When the Weibull model showed the closest agreement to a sample, it was usually only slightly better than one of the other models. The normal models showed the closest agreement to 7 samples, the log normal to 22 samples, and the exponential to 4 samples. The data indicate that a simple general model applicable to all the frequency distributions of radiocesium concentrations may not exist. The frequent rejection of the hypothesis--cumulative distribution function $F(x)=S(x)$ (sample cumulative distribution)--for all models, the occurrence of at least some large values of distribution for each model, and the reduction in skewness and kurtosis from producers to consumers indicate that the distributions are too complex and varied to be accurately modeled by any one of the four distributions considered. (See also W76-10266) (Auen-Wisconsin)
W76-10273

FACTOR ANALYSIS: AN EXPLORATORY TECHNIQUE APPLIED TO MINERAL CYCLING,
Georgia Univ., Athens. Inst. of Ecology.
J. B. Nabholz, and T. H. Richardson.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, p 126-141. 1 fig, 4 tab, 43 ref, 2 append, (CONF-740513).

Descriptors: *Statistical methods, *Correlation analysis, *Ecosystems, APproximation method, Probability, Computer programs.
Identifiers: *Factor analysis.

Factor analysis is a multivariate statistical method that constructs artificial (unobservable) variables to explain the dependence structure found in a correlation matrix. These artificial variables are called common factors. A vector of correlations is generated between the observable attributes and such common factors. These attributes, highly correlated with a common factor, form a group the members of which share some common property over and beyond that which they share with other observed attributes. The exploratory approach is used to gain a better understanding of complex and poorly defined interrelationships among a large set of imprecisely measured attributes. Factor analysis consists of two separate procedures--factor extraction followed by factor rotation. The analysis is always started from a correlation matrix computed from a sample variance-covariance matrix or a multiple thereof, e.g., the matrix of sums of squares and products for error. Factor analysis, its definition, and historical roots are discussed. This statistical technique is contrasted with pseudo factor analysis, i.e., principal-components analysis. Factor extraction and factor rotation, as they apply in factor analysis, are clarified and interpreted. Advantages and disadvantages of the statistical method are enumerated. Applications of factor analysis in mineral-cycling studies and their usefulness in ecology are presented. (See also W76-10266) (Auen-Wisconsin)
W76-10274

A SPECIFIC-ACTIVITY AND CONCENTRATION MODEL APPLIED TO CESIUM MOVEMENT IN AN OLIGOTROPHIC LAKE,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 5C.
W76-10275

THE ROLE OF PHYSICAL MODELING IN MARSH-ESTUARINE MINERAL-CYCLING RESEARCH,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab.
R. L. Eley, J. W. Falco, and C. J. Kirby.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems' 1975, (CONF-740513), p. 166-178, 2 fig, 1 tab, 30 ref.

Descriptors: *Model studies, *Cycling nutrients, *Tidal marshes, *Estuaries, Ecosystems, Environmental effects, Hydrologic aspects, Design criteria, Louisiana, Hydraulic models, Heavy metals.
Identifiers: Physical models, Mineral cycling, Barataria Bay(La).

Physical modeling of marsh-estuarine ecosystems as a supplement to traditional field, laboratory, and mathematical modeling research is discussed, together with their functions in designing and interpreting field studies and in developing and verifying mathematical models. Physical hydraulic models constructed for engineering purpose--navigation and coastal construction projects--can provide significant assistance in mineral-cycling research. The design of a simulator of Barataria Bay, Louisiana, suitable for studying mineral cycling between a shallow estuary and the surrounding tidal marsh ecosystem, is described. The simulator was formulated for use in treatment-control experiments to study differences between nutrient and heavy-metal cycling in natural marsh-estuarine ecosystems and those in ecosystems artificially created with dredged material. The model included representative fauna and flora of the Barataria Bay, consisting of no less than 8 genera of algae and 30 genera of animals representing major phyla from Protozoa to Chordata; these included snails, crabs, shrimp, small fin fishes, and marshgrass insects. The marsh was dominated by Spartina alterniflora with some Distichlis specata. (See also W76-10266) (Auen-Wisconsin)
W76-10276

DISTRIBUTION OF COPPER AND ZINC IN OYSTERS AND SEDIMENTS FROM THREE COASTAL-PLAIN ESTUARIES,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5C.
W76-10279

THE ROLE OF SPARTINA ALTERNIFLORA IN THE FLOW OF LEAD, CADMIUM, AND COPPER THROUGH THE SALT-MARSH ECOSYSTEM,
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5C.
W76-10281

CONCENTRATIONS OF TOTAL MERCURY AND METHYL MERCURY IN FISH AND OTHER COASTAL ORGANISMS: IMPLICATIONS TO MERCURY CYCLING,
Skidaway Inst. of Oceanography, Savannah, Ga.
W. S. Gardner, H. L. Windom, J. A. Stephens, F. E. Taylor, and R. R. Stickney.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975 (CONF-740513), p. 268-278. 1 fig., 1 tab., 17 ref. NSF GX-33615.

Descriptors: *Mercury, *Fish, *Rooted aquatic plants, *Crustaceans, *Estuaries, South Carolina, Georgia, Florida, Food chains.
Identifiers: *Methyl mercury, Spartina alterniflora, Osteichthyes, Chondrichthyes.

Total and methyl mercury concentrations were determined in a variety of fish, crustaceans, and Spartina alterniflora in estuaries along the coasts of South Carolina, Georgia, and Florida. Higher levels of mercury were found in fish tissues. Because of its relative stability in biological

systems and its unique biochemical characteristics, methyl mercury apparently is metabolized differently than is inorganic mercury, which may explain the greater mercury accumulation in fish. This difference would be expected if the fish were exposed to methyl mercury as it is accumulated in the muscles. Molluscan studies have shown that mercury administered in different forms is excreted at different rates, but methyl mercury was retained much longer than either inorganic mercury and phenyl mercury. The concentration of total mercury relative to methyl mercury in livers and spleens may be indicative of the quantity of inorganic mercury or nonmethyl organic forms to which the fish have been exposed over short periods of time, whereas mercury in muscle tissue represents accumulation of methyl mercury over longer periods. Methyl mercury potentially can be transported upward through Spartina plants thus if the mercury is released to the water column, it could be taken up by fish, which could explain the higher mercury levels in finfish than in the intermediate food-chain members. (See also W76-10266) (Auen-Wisconsin).
W76-10283

MINERAL PATHWAYS IN SMALL APPALACHIAN STREAMS,
Georgia Power Co., Atlanta. Environmental Div.
W. R. Woodall, and J. B. Wallace.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 408-422. 1 fig., 5 tab., 39 ref. NSF AG-199, 40-193-69; FWQA 18050DPQ.

Descriptors: *Cycling nutrients, *Streams, *Energy budget, *Benthic fauna, Appalachian Mountain Regions, Detritus, Standing crops, Leaves, Litter, Crayfish, Salamanders, Potassium, Calcium, Magnesium, Food webs, Leaching, Animal metabolism, North Carolina, *Path of pollutants.
Identifiers: Coweeta Hydrologic Laboratory(NC).

The effects of the metabolism of benthic fauna on the flux of potassium, calcium and magnesium were studied in streams of the Coweeta Hydrologic Laboratory draining southern North Carolina watersheds covered with different vegetation types. Most detritivore and predator standing-crop biomass consisted of crayfish and salamanders, respectively, and accounted for most flux in those food web compartments; they may be important in small stream nutrient flows because they form a sink in the remineralization process. Potassium increases and calcium and magnesium decreases were associated with increased trophic levels. Because food materials were richer in calcium and magnesium than potassium, detritivores concentrated proportionately more potassium. Potassium was principally released from detritus by leaching and calcium and magnesium were released by detritivores feeding on leaves. Cation standing crops in detritus from hardwood and coppice streams were larger than in pine and old-field detritus. Detritus contained more calcium than potassium and magnesium. Coweeta streams are small, so detritus may be more important than in larger streams. Nutrient removal from watersheds by streams is enhanced by invertebrate breakdown of leaf material. The agreement between ingestion and available food explains why there is no long-term detritus accumulation in streams. Because some organisms eat detritus egested by others, available detrital food can be increased 2.5 times. (see also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10291

ORGANICALLY COMPLEXED COPPER, ZINC, AND CHELATING AGENTS IN RIVERS OF WESTERN PUERTO RICO,
Puerto Rico Nuclear Center, Mayaguez.
J. R. Montgomery, and J. E. Echevarria.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 423-434. 1 fig., 3 tab., 29 ref. AEC AT(40-1)-1833.

Descriptors: *Copper, *Zinc, *Chelation, *Rivers, *Puerto Rico, Trace elements, Metals, Organic matter, Water pollution effects, Organic loading, Calcium, Tropical regions, Suspended solids.
Identifiers: *Organic chelators, Guanajibo River(PR), Anasco River(PR), Culebrinas River(PR).

During a study of a trace-metal transport from terrestrial to marine environments at the Puerto Rico Nuclear Center, a method for determination of soluble chelators was used which gave their concentration in copper-equivalent chelating capacity units in fresh or slightly brackish water. Soluble chelators were determined in three Puerto Rican rivers. High values were found in a shallow clear river and below San German which discharges municipal sewage into the Guanajibo River in February when there was also an increased organic load from a sugar mill, decreased rainfall, and increased mean organic matter concentration due to low runoff. There were enough chelating agents in the river water to complex all soluble copper and zinc ions present, but only about 44% of the copper and 75% of the zinc ions were organically complexed. The high calcium ion to copper ion ratio probably prevented formation of more organically complexed copper. Chelator concentrations in tropical rivers seemed higher than in Canadian lakes. Soluble chelator concentrations were directly related to organic material input from municipalities and a sugar mill and inversely related to river particulate matter increases during the rainy season. No significant correlation was found between particulate organic carbon, dissolved reactive phosphate, and chelator concentrations. (See also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10292

REDISTRIBUTION OF CESIUM-137 IN SOUTHEASTERN WATERSHEDS,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
J. R. McHenry, and J. C. Ritchie.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 452-461. 1 fig., 3 tab., 13 ref. AEC AT(49-7)-3029.

Descriptors: *Distribution, *Cesium, *Radioisotopes, *Watersheds(Basins), *Southeast U. S., Radioactive fallout, Sediments, Soil erosion, Erosion rates, Reservoirs, Cultivated lands, Crops, Georgia, Kentucky, Maryland, Mississippi, North Carolina, West Virginia.

Movement of radioactive materials in watershed ecosystems must be understood so that decisions on locating nuclear reactors and the release of radioactive materials from reactors can be made to ensure safety and sustain the ecosystems. Cesium-137 fallout from nuclear bomb tests in the 1950s and 1960s was studied in soil surface samples of 14 southeastern watersheds and agricultural reservoir sediments. Cesium-137 levels reflected the nature of the watershed, its cover, and land use. Since cesium-137 distribution results from soil erosion, recent erosion rates were calculated from cesium-137 accumulations in sediments and from decreases in cesium-137 calculated to have been deposited on upland soils. In the watersheds studied, most cesium-137 fallout remained in the watershed. Some moved from the watershed as shown by an areal cesium-137 buildup in sediments of reservoirs controlling watershed outflows. Cesium-137 loss was greater from cultivated than uncultivated watersheds. A considerable amount of the cesium-137 deposited on cultivated areas is removed with crops. If an agricultural watershed was greatly contaminated, little radioactive loss would be expected if crops were not removed. If fine particles entering reservoirs with runoff were flocculated, radioactivity losses through the reservoirs would be reduced. The Cs-137 loss is very small (5%) from uncultivated watersheds. (See also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10295

RADIOCESIUM CYCLING IN VEGETATION AND SOIL,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
R. C. Dahlman, C. W. Francis, and T. Tamura.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 462-481. 2 fig., 7 tab., 57 ref.

Descriptors: *Cesium, *Radioisotopes, *Vegetation, *Soils, Coastal plains, Dynamics, Nuclear reactors, Watersheds(Basins), Radioactive fallout, Clay minerals, Food chains, Root systems, Absorption, Southeast U.S., Milk, Florida, Georgia, Forage grasses.
Identifiers: Tampa(Fla).

Factors that influence the cycling of cesium in terrestrial ecosystems, especially mechanisms influencing the dynamics and fate of Cs-137 in pathways leading to man, are reviewed. Clay minerals in soil, especially micaceous types, fix cesium effectively and remove it from biotic components of ecosystems. Fallout Cs-137 enters food chains primarily by direct deposition on vegetation; uptake by roots is usually less. Soil serves as an effective sink for Cs-137, thus minimizing uptake by roots. Movement from soil to plants is dependent on the temperature, moisture, fertility, hydrogen ion concentration, and the physical, mineral, chemical, and biological conditions of the soil. The estimated Cs-137 concentrations, based on current concepts of its dynamics in vegetation and fixation in soil, agree with values found in vegetation collected in 1969-1970. Mechanisms of direct deposition and increased root uptake due to absence of micaceous clays explain the higher levels found in vegetation in the southeastern U.S. Coastal Plain and were therefore responsible for the high Cs-137 levels found in milk from the Tampa, Florida, watershed. Mycorhizal, symbiotic enhancement of uptake may also affect levels of Cs-137 in vegetation and milk. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10296

ACCUMULATION AND MOBILITY OF CESIUM IN ROOTS OF TULIP POPLAR SEEDLINGS,
Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries, and Wildlife Development.
T. L. Cox.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 482-488. 2 tab., 8 ref.

Descriptors: *Cesium, *Root systems, *Radioisotopes, *Trees, Seasonal, Forest soils, Sorption, Root zone, Distribution, Path of pollutants.
Identifiers: *Tulip poplar.

Seasonal distributions in different root-diameter classes and cesium pathways to forest soils were studied in the tulip poplar, Liriodendron tulipifera, seedlings stem-well tagged with Cs-134, harvested periodically, and separated into shoot and root compartments. Roots less than 0.1 cm in diameter contained 1.5 and 3.0 times the cesium in roots 0.1-0.5 cm and 0.5-1.0 cm in diameter, respectively. Roots contained 24% of the seedling cesium pool in one week, 40% in seven weeks, and 65% eight months after tagging. Roots less than 0.5 cm in diameter contained approximately 36% the seedling pool (root and shoot) and 72% of the cesium pool after a year. Small roots accounted for a considerable portion of annual turnover in the root systems. Growth dilution, leaching, exudation, sloughing, translocation from soil and shoot parts, etc., accounted for seasonal concentration changes. Analysis of soil treatment effects showed that root processes contributed twice as much cesium to the soil as combined aboveground processes. Determination of seasonal distributions of root biomass by diameter class is important in determining the role of roots in accumulation and transfer of cesium and analagous elements, since most annual turnover by mortality occurs in roots

less than 0.5 cm in diameter. (See also W76-10266) (Buchanan-Davidsoni-Wisconsin)
W76-10297

DISTRIBUTION OF RADIOCESIUM IN VEGETATION ALONG A CONTAMINATED STREAM,
Savannah River Ecology Lab., Aiken, S.C.
L. A. Briese, C. T. Garten, and R. R. Sharitz.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 509-517. 2 fig., 1 tab., 15 ref. AT(38-1)-708, AT(38-1)-819.

Descriptors: *Cesium, *Radioisotopes, Vegetation, Streams, South Carolina, Nuclear wastes, Leaves, Streamflow, Distribution, Southeast U.S., Soil contamination, Water pollution, Willow trees, Statistical methods, Path of pollutants.
Identifiers: *Steel Creek(SC), Arrowhead, Smartweed, Woolgrass.

Radiocesium concentrations were measured in leaves of plants along Steel Creek which was contaminated by radioactive effluent from nuclear production reactors at the Savannah River Plant, South Carolina. Leaves of Sagittaria latifolia, Salix nigra, Polygonum punctatum, and Scirpus cyperinus averaged 488.2, 303.2, 191.7, and 86.4 picocuries per gram dry weight, respectively. Radiocesium distribution in vegetation was species specific and independent of distance from the effluent entry point. Leaf radiocesium concentrations were generally higher where the streamflow rate decreased due to impoundments, fallen trees, or increased stream width. Radiocesium levels in these plants were log normaly distributed at all sites. A significant linear relationship existed between the variance and the mean picocuries per gram; however each species had a different slope and intercept. The radiocesium concentrations in one species could not be used to predict concentrations in another. Physical and biological factors should be considered when evaluating the possible influences of radioactive releases on aquatic systems to determine if a system will accumulate radionuclides. Surveys of aquatic systems should determine where contaminants might accumulate. Accessibility of possible contaminants to the biota and public should be considered. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10300

SEASONAL AND ANNUAL VARIATIONS IN THE QUANTITIES OF NITROGEN, POTASSIUM, PHOSPHORUS, MAGNESIUM, CALCIUM, AND MANGANESE REACHING THE FOREST FLOOR AS MAST IN PENNSYLVANIA AND VERMONT FORESTS,
Massachusetts Univ., Amherst. Dept. of Zoology.
D. L. Graybill, D. P. Snyder, C. A. Tryon, and R. T. Hartman.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 564-579. 3 tab., 47 ref. AEC C00-3426-3, C00-3329-3.

Descriptors: *Forests, *Seasonal, *Nutrients, *Annual, *Trace elements, Nitrogen, Potassium, Phosphorus, Magnesium, Calcium, Manganese, Foods, Pennsylvania, Vermont, Cycling nutrients, Seeds, Litter.
Identifiers: Mast crops, Fruits, Eastern chipmunks.

Variations in selected nutrients reaching the forest floor as mast were studied monthly in forests near Linesville, Pennsylvania; Tionesta Natural Area, Kane, Pennsylvania; and the Green National Forest, Manchester, Vermont. Approximate nitrogen, potassium, phosphorus, magnesium, calcium, and manganese concentrations were determined in selected parts of species collected. Nitrogen was the most abundant element in edible mast; manganese the least abundant; while the other elements varied. Geographic variations of nutrients in edible mast exceeded two orders of magnitude. Annual variations in macronutrient production exceeded one order of magnitude in Vermont but were approximately half an order of magnitude in Pennsylvania. Seasonal variations were related to species composition and mast crop size at each site. Annual differences in seedfall times varid. Fruits of beech, sugar maple, birch, and fall seed producers reaching the ground before September contained little edible material. Spatial distribution of mast was uneven and varied yearly, especially in Pennsylvania. Relationships between edible mast and litter were not analyzed. Fate of nutrients in mast is known; eastern chipmunks are probably the granivores consuming the mast as edible mast disappears rapidly after reaching the forest floor. Chipmunks are the major method of moving nutrients from forest fruits and seeds in these areas. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10306

FALLOUT CESIUM-137 AND MINERAL-ELEMENT DISTRIBUTION IN FOOD CHAINS OF GRANITIC-OUTCROP ECOSYSTEMS,
Georgia Univ., Athens. Inst. of Ecology.
D. A. Crossley, K. M. Duke, and J. B. Waide.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 580-587. 2 tab., 14 ref. AEC AT(38-1)-641.

Descriptors: *Cesium, *Nutrients, *Fallout, *Food chains, *Radioisotopes, Georgia, Poteassium, Lichens, Mosses, Plant tissues, Invertebrates, Sodium, Calcium, Carnivores, Mountains, Slopes, Herbivores, Vegetation, Insects, Southeast U. S.
Identifiers: Arthropods, Panola(Ga), Arabia Mountains(Ga), Granitic outcrops.

To understand nutrient conservation mechanisms in ecosystems and provide information on environmental behavior of radioactive materials, fallout cesium-137 movement through arthropod food chains in the Panola and Arabia mountains, granite monadnocks in the Georgia Piedmont region, was studied. Potassium was low in lichen, intermediate in mosses, and highest in vascular plants; similar but lower results were observed for sodium. Calcium was low in lichens and similar in mosses and vascular plants. Cs-137 decreased from lichens to mosses to vascular plants. Parmelia lichens contained the most Cs-137 and Cladonia lichens and mosses concentrated more Cs-137 than most vascular plants. Arthropod food chains on mountain slopes contained 3-5 times more Cs-137 than adjacent areas or mountaintops. Largest Cs-137 levels were found in herbivores from mountain slope areas with reduced concentrations in predators. Food bases were identified by observation and from cesium/potassium ratios in vegetation and arthropods. Lichens were major accumulators of Cs-137 but were not important food sources for arthropods. Cs-137 levels decreased in food chains. Sampling sites did not affect arthropod mineral concentrations. Trophic level effects were observed for sodium but not potassium or calcium; predators contained more sodium than herbivores. Winged forms usually had lower concentrations than wingless forms of all elements at both trophic levels. (See also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10307

RESOURCE PARTITIONING IN LEAF-LITTER FAUNAS FROM HARDWOOD AND HARDWOOD-CONVERTED-TO-PINE FORESTS,
Battelle-Columbus Labs., Ohio. Ecology and Ecosystems Analysis Section.
B. W. Cornaby, C. S. Gist, and D. A. Crossley.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 588-597. 2 fig., 1 tab., 15 ref. NSF AG-199, 40-193-69, AEC AT(38-1)-641.

Descriptors: *Forests, *Litter, *Leaves, *Biological communities, *Cycling nutrients, Hardwood, White pine trees, North Carolina, Model studies, Detritus, Calcium, Potassium, Deciduous forests, Food webs.
Identifiers: Coweeta Hydrologic Station(NC), Forest litter fauna.

Litter fauna structure and function were measured in hardwood and adjacent white pine watersheds in the Coweeta Hydrologic Station, North Carolina. Models of the role of litter fauna in the watersheds are compared. Biomass of about 18 combined taxa of litter animals were approximately one-third lower, numerical by one-half lower, and calcium and potassium standing crops lower in the pine compared to the hardwood system. Average biomass was 1.30 and 3.81 g/sq m in pine and hardwood watersheds, respectively. In the hardwood watershed 11% of calcium and 3% of potassium from annual leaf-litter inputs were processed by litter animals. Approximately 2% of calcium and 28% of potassium from annual litter inputs entered food webs of pine litter fauna. Pine litter fauna used about 1/10th as much calcium. There was about three times more potassium in pine than hardwood watersheds. The hardwood detrivore calcium standing crop and fauna calcium intake were about ten times larger. Calcium fauna utilization was related to fauna standing crops and perhaps annual litter input, but not litter standing crop. Relationships between potassium standing crops and inputs were not clear. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10308

FOREST-FLOOR NUTRIENT DYNAMICS IN SOUTHERN APPALACHIAN HARDWOOD AND WHITE PINE PLANTATION ECOSYSTEMS,
Environmental Protection Agency, Washington, D. C. Office of Environmental Sciences.
J. D. Yount.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 598-608. 2 fig., 3 tab., 14 ref. NSF AG199, 40-193-69.

Descriptors: *Cycling nutrients, *Forests, Hardwood, White pine trees, Litter, North Carolina, Coniferous forests, Deciduous forests, Appalachian Mountain Region, Forest soils, Biomass, Detritus, Carbon, Soil profiles, Decomposing organic matter, Magnesium, Potassium, Calcium, Sodium, Nitrogen, Phosphorus, Microbial degradation, Leaching.
Identifiers: Coweeta Hydrologic Laboratory(NC).

Nutrient contents and detrital biomass in hardwood and white pine forest floors at Coweeta Hydrologic Laboratory, North Carolina, were studied for a year. Total carbon storage was higher in the pine forest floor where the biomass probably approached a steady state. Three pine and two hardwood litter layers were distinguishable; transition from forest floor-soil was sharp in pine and broad in hardwood forests. Comparisons of litter component concentrations through litter profiles indicated dynamics of litter decomposition and elemental mobilities. Ash-free organic matter, magnesium, and potassium decreased; calcium, sodium, nitrogen, and phosphorus increased. Potassium and nitrogen mobilities were high in both forest floors. Magnesium loss was more closely related to structural breakdown in hardwood than pine litter. In both litter types calcium and phosphorus losses were related to loss rate of the whole forest floor. Forest-nutrient pools result from competing porcesses: litterfall, precipitation, leaching, and microbial decomposition, immobilization, or uptake. For nitrogen, fixation, nitrification, and denitrification processes should be added. These processes cause selective calcium and magnesium concentration in hardwood, nitrogen and phosphorus in pine, and potassium and sodium in both forest floors. (See also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10309

LITTER PRODUCTION, DECOMPOSITION, AND NUTRIENT CYCLING IN A MIXED HARDWOOD WATERSHED AND A WHITE PINE WATERSHED.
Georgia Univ., Athens. Dept. of Botany.

K. Cromack, and C. D. Monk.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 609-624. 4 tab., 45 ref. NSF AG-199, 40-193-69, NSF GB-20963.

Descriptors: *Litter, *Biodegradion, *Cycling nutrients, Coniferous forests, Deciduous forests, Hardwood, White pine trees, North Carolina, Biomass, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Energy transfer, Leaves, Lignins, Cellulose, Fibers(Plant), Regression analysis.
Identifiers: Coweeta Hydrologic Laboratory(NC).

Nutrient cycling from litter production and litter decomposition in a mixed-hardwood ecosystem were compared with the same processes in an adjacent white pine plantation in the Coweeta Hydrologic Laboratory, North Carolina. Litterfall data (biomass of litter; nitrogen, phosphorus, potassium, calcium, magnesium; and structural organic constituents of leaf litter--lignin, cellulose, and total fiber) were obtained for leaves, stems, flowers, acorns, and miscellaneous debris in the hardwood watershed and for needles, stems, and cones in the pine watershed. Total annual litter production in the hardwood watershed was 4369 kg/ha in 1970-1971, of which 64% was leaf litter. Production of shrubs and herbaceous litter was about 370 kg/ha/year. Pine litter production was 3253 kg/ha/year, of which 98% was needle litter. Litter decomposition data were obtained by studying weight loss rates and nutrient loss rates. The first-year litter breakdown rate of confined mixed-hardwood leaf litter was $k = -0.70$ per year and of confined white pine needle litter was $k = 0.46$ per year. Litter decomposition rates of chestnut oak, white oak, white pine, red maple, and dogwood could be correlated with senescent leaf carbon-nitrogen ratio and the sclerophyll index, which gave a better statistical estimate of the decomposition rate. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10310

CERIUM AND COBALT MOVEMENT WITH LITTER LEACHATE IN A FOREST SOIL,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
W. A. Thomas.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 625-629. 1 tab, 12 ref.

Descriptors: *Cobalt, *Radioisotopes, *Kinetics, *Translocation, *Forest soils, Root zone, Leachate, Leaves, Deciduous forests, Tennessee, Hickory trees, Penetration, Regression analysis, *Path of pollutants.
Identifiers: *Cerium, Mockernut hickory, Black gum, Chestnut Ridge(Tenn).

To interpret studies of cerium and cobalt circulation in deciduous forests, the rates these elements move downward in soil after release from decomposing leaves were determined. Leachate containing cerium-144 and cobalt-60 from leaf litter of mockernut hickory (Carya tomentosa) and black gum (Nyssa sylvatica) trees was applied to a forest soil, and the rates at which these elements moved downward after release in the litter layer determined. Leachate was applied in a single application, in a single application at twice the concentration, and in four periodic applications over a yearly period. Relative penetration, determined by regression analysis, describing cerium-144 and cobalt-60 distribution four years after the first application did not differ between the different applications, but cerium-144 movement exceeded that of cobalt-60 in all applications. A combination of chemical and physical phenomena retained both elements in the biologically active zones of the soil. The organic layer and the upper three centimeters of the mineral soil contained 68% of the cerium and 91% of the cobalt. The organic layer and upper nine centimeters of mineral soil retained all detectable cerium and cobalt, indicating that these elements will be retained in the biologically active zone in the soil-vegetation-litter nutrient cycle. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10311

LEACHING OF NUTRIENTS FROM LEAVES OF SELECTED TREE SPECIES IN NEW HAMPSHIRE,
New Mexico Univ., Albuquerque. Dept. of Biology.
J. R. Gosz, G. E. Likens, J. S. Eaton, and F. H. Bormann.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 630-641. 3 tab, 20 ref. NSF GB1144, GB4169, GB6757, GB6742.

Descriptors: *Cycling nutrients, *Leaching, *Leaves, *Trees, New Hampshire, Forests, Hardwood, Laboratory tests, Calcium, Magnesium, Potassium, Sodium, Nitrogen, Maple trees, Birch trees, New Hampshire, Light intensity.
Identifiers: Beech trees, Hubbard Brook Forest(NH).

Although leaching is a very important process in natural, forested watershed ecosystems, its role is not well understood, and because of the complexity of plant communities and environmental interactions, field data are hard to interpret. Therefore laboratory studies were made of the amount and rate of leaching of calcium, magnesium, potassium, and sodium ions and total nitrogen from foliage of different species, leaf types, and maturities. Leaves of sugar maple, yellow birch, and beech were placed in containers of water under controlled conditions. The greatest leaching was observed with sugar maples, followed by yellow birch, then beech. In early summer, sun leaves leached faster than shade leaves, but with increased maturity. This difference was less pronounced and became insignificant after abscission. The rate and amount of leaching for all species and all elements except sodium increased with leaf maturity to a maximum after abscission. The rate of nutrient removal in all three species was potassium, magnesium, calcium, nitrogen and sodium in decreasing order. Loss of sodium from leaves was negligible. The results compared favorably with field studies, so this is a simple, reliable way to evaluate the relative mobility of nutrients in leaf tissue subject to throughfall or decomposition processes. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10312

PHOSPHORUS CYCLING IN A MARYLAND DECIDUOUS FOREST SUBJECTED TO VARIOUS LEVELS OF MINERAL-NUTRIENT LOADING,
Smithsonian Institution, Rockville, Md. Radiation Biology Lab.
D. L. Correll, and J. J. Miklas.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 642-657. 2 fig, 4 tab, 19 ref.

Descriptors: *Phosphorus, *Cycling nutrients, *Deciduous forests, *Kinetics, Movement, Leaves, Litter, Forest soils, Mode of action, Maryland, Tracers, Radioisotopes, Chemical reactions.

The phosphorus cycle was studied in a deciduous temperate forest using carrier-free phosphorus-32 to measure overall phosphorus flux rates and pathways. Phosphorus loading of the leaf-litter zone was varied from natural phosphorus levels of 3 to 12 mg to 430 mg/sq m/day. Kinetics of phosphorus flux in leaf litter, at various soil depths, in horizontal transects, and in tree leaves were estimated from rates of change of specific and total activities. Little phosphorus moved very far into the soil before biological assimilation. Within 11 days, chemical fractions in leaf litter were almost uniformly labeled and leaf-litter total phosphorus specific activity was 200 times higher than soil total phosphorus 3 to 5 cm deep; flux rates through leaf litter under natural loading were only about 1% of total leaf litter phosphorus/day. Biological pathways and mechanisms were defined using phosphorus fractions. When loading was increased, the litter phosphorus content increased fourfold, then stabilized. When loading was discontinued, litter phosphorus decreased to original levels in four months. Phosphorus which was not assimilated by leaf litter moved vertically into soil and horizontally within soil inside microbial cells. Forest trees obtained most of their phosphorus from the litter zone. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10313

MOBILIZATION OF NUTRIENTS IN SOIL BY ACIDS OF SULFUR AND CHELATING AGENTS,
California Univ., Los Angeles, Lab., of Nuclear Medicine and Radiation Biology.
A. Wallace, E. M. Romney, and J. Procopiou.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 687-693. 2 tab., 13 ref. AEC AT (04-1) GEN 12, AT(04-3)-34.

Descriptors: *Cycling nutrients, *Acid base equilibrium, *Salts, *Vegetation, *Sulfur, *Chelation, Air pollution, Hydrogen ion concentration, Southeast U. S., Solubility, Absorption, Heavy metals, Lime, Soybeans, Manganese, Iron, Zinc, Copper, Cobalt, Nickel, Phosphorus, Silver, Magnesium, Lithium, Aluminum, Barium, Potassium, Calcium, Barley, Molybdenum.

Atmospheric precipation of sulfur on southeastern ecosystems was studied by measuring effects of soil acidification with sulfur on ion uptake by plants and leaching from soil. Slightly acid soil (Yolo loam) was treated with sulfur or lime to determine effects on mineral mobilization by soybeans (Glycine Max) and barley (Hordeum vulgare). The soils were treated with the chelator, ethylenediamine tetraacetic acid. With soybeans acidification decreased yields; increased plant manganese, iron, and zinc and increased soil copper, cobalt, nickel, phosphorus, silver, and magnesium; and decreased molybdenum and varium availability. Lime had the opposite effect, and increased molybdenum levels in soybeans and soil. EDTA increased iron and decreased manganese in pH 6.0 and 4.5 soils; increased leaf iron, manganese, zinc, and copper at pH 7.5 and cobalt and nickel at pH 6.0 and 4.5, but did not affect soybean accumulations of other elements. With barley, acidification increased manganese, cobalt, lithium, and aluminum and decreased molybdenum, barium, phosphorus, potassium, and calcium; except for iron at pH 4.5, there was little interaction with EDTA. Acidification can change soil mineral solubilities and increase plant heavy metal concentrations. Atmospheric sulfur could affect mineral recycling in ecosystems with poorly buffered soils; interactions with soil organic constituents which chelate minerals are possible. (See also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10316

EFFECTS OF TREE SPECIES, TEMPERATURE, AND SOIL ON TRANSFER OF MANGANESE-54 FROM LITTER TO ROOTS IN A MICROCOSM,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W76-10317

ASPECTS OF MINERAL-NUTRIENT CYCLING IN A SOUTHERN MIXED-HARDWOOD FOREST IN NORTH CENTRAL FLORIDA,
Florida Univ., Gainesville. Dept. of Botany.
K. C. Ewel, J. F. Gamble, and A. E. Lugo.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 700-714. 1 fig., 4 tab., 20 ref. AEC AT(40-1)-4066.

Descriptors: *Cycling nutrients, *Mixed forests, Florida, Cesium, Radioisotopes, Hardwood, Fallout, Southeast U. S. rainfall, Leaching, Soil types, Groundwater, Stemflow, Throughfall, Phosphorus, Potassium, Calcium, Magnesium, Phizosphere.

To determine if cesium-137 accumulates in a natural system in a compartment which has a counterpart in a managed system, mineral cycles were studied in a relatively undisturbed ecosystem (a mixed-hardwood forest near Gainesville, Florida, which contained several species of evergreen hardwoods as canopy dominants). Special attention was given to pathways which might affect cesium distribution in the ecosystem. Seasonal analysis was made of rainfall composition to determine how it was affected by different ecosystem components encountered as water travelled to the forest floor and leached through the soil system to groundwater. Stemflow, throughfall, and rainfall samples were collected for two years and mineral nutrient inputs (phosphorus, calcium, magnesium, potassium) to the forest floor estimated. Total nutrient inputs were phosphorus-32, potassium--24.7, calcium--29.7, and magnesium--8.1 kg/ha/year. Nutrient concentrations were unusually high in rainfall. Species of evergreen trees seemed to play an important role in making these values higher than those from temperate hardwood forests. There was a simildarlity in potassium and Cs--137 concentration patterns. In samples from lysimeters and groundwater pits, potassium and Cs-137 concentratios dropped considerably as the water passed through the root zone in the soil, possibly due to mycorrhizal uptake. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10318

THE QUANTITY AND DISTRIBUTION OF FOUR NUTRIENT ELEMENTS IN HIGH-ELEVATION FOREST ECOSYSTEMS, BALSAM MOUNTAINS, NORTH CAROLINA,
Southern Illinois Univ., Carbondale, Dept. of Forestry.
G. T. Weaver.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 715-728. 5 tab., 36 ref. AEC AT(401)-2077.

Descriptors: *Nutrients, *Mountain forests, North Carolina, Calcium, Potassium, Magnesium, Phosphorus, Distribution, Fir trees, Birch trees, Vegetation, Forest soils, Trees, Shrubs, Mosses, Soil horizons.
Identifiers: *Balsam Mountains(NC), Red spruce, Forest floor.

Calcium, potassium, magnesium, and phosphorus concentration and distribution patterns were studied in red spruce (Picea rubens)-Fraser fir (Abies Fraseri) and yellow birch (Betula lutea) ecosystems in the Balsam Mountains, North Carolina, to see if nutrient pool size and location characterized ecosystems. Relative nutrient quantities decreased in order from calcium:potassium:magnesium:phosphorus. Except that phosphorus amounts differentiated immature ecosystems, ecosystems were not characterized by nutrient pool size. Nutrient sinks for calcium were equal in vegetation and forest floor but lower in soil; in the spruce-fir ecosystem, magnesium, phosphorus, and potassium values were higher in the forest floor than vegetation and lower in soil; in the yellow birch ecosystem, vegetation, soil, and forest floor potassium values were equal. Nutrient distribution differentiated these ecosystems. Larger trees and shrubs contained most of the nutrients in the vegetational compartment. Most nutrients were in boles in the spruce-fir ecosystem, but branches were equal or more important in yellow birch ecosystems. Mosses and herbs were important nutrient sinks in habitats where they developed. Within the forest floor most calcium and magnesium were in the 01 horizon and potassium and phosphorus in the 02 horizon. Relative dry matter distribution did not indicate nutrient distributions reliably. (See also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10319

SIGNIFICANCE OF BIOLOGICAL NITROGEN FIXATION AND DENITRIFICATION IN A DECIDUOUS FOREST ECOSYSTEM,
Georgia Univ., Athens. Dept. of Agronomy.
R. L. Todd, J. B. Waider, and B. W. Cornaby.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 729-735. 2 tab., 26 ref. NSF AG 199,40-193-69.

Descriptors: *Nitrogen fixation, *Denitrification, *Deciduous forests, *Nitrogen cycle, North Carolina, Litter, Forest soils, Oak trees, Hickory trees, Input-output analysis.
Identifiers: Coweeta Hydrologic Laboratory(NC), Forest floors.

Gaseous nitrogen transformations were determined in relation to other nitrogen cycle components of a mixed deciduous forest ecosystem at the Coweeta Hydrologic Laboratory, North Carolina. Rates and total annual amounts of nitrogen fixation and potential denitrification were measured for litter-soil subsystem components (decaying logs, woody and leaf litter, and general soil layers) of a mature oak-hickory forest. Woody and leaf litter had thehighest nitrogen fixation and denitrification rates, but annually on a surface area basis, the largest nitrogen transformations occurred in soil. About 75% of total nitrogen input entered the forest floor via biological fixation. Potential denitrification losses exceeded streamwater losses 200-fold. Aqueous nitrogen inputs and outputs are major forest nitrogen cycle components and dominate total gains and losses. Total nitrogen input was 14 and output 18 kg/ha/year, suggesting that the watershed may be losing nitrogen slowly. The estimates did not include epiphytic N fixation in the aboveground vegetation nor particulate organic N input in bulk precipitation. These nitrogen fixation values are comparable to values for coniferous forests and may be applicable only for forests. Nitrogen fixation, denitrification, and total fluxes must be considered when examining forest nitrogen cycles. Existing nitrogen pools may not indicate the magnitude of gaseous transformations that are occurring. (See also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10320

NUTRIENT RETURN IN THE STEMFLOW AND THROUGHFALL OF INDIVIDUAL TREES IN THE PIEDMONT DECIDUOUS FOREST,
Duke Univ., Durham, N. C. Dept. of Botany.
D. T. Patterson.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 800-812. 6 tab., 18 ref.

Descriptors: *Cycling nutrients, *Rainfall, *Stemflow, *Throughfall, *Deciduous forests, Hickory trees, Pine trees, Loblolly pine trees, Oak trees, North Carolina, Bark, Interception, Chemical analysis, Calcium, Potassium, Magnesium, Manganese, Forest soils, Hydrogen ion concentration.
Identifiers: Piedmont, American beech trees, Yellow poplar trees, Shortleaf pine trees.

Quantitative and qualitative aspects of rain stemflow and throughfall of individual mature trees (American beech, mockernut hickory, yellow poplar,shortleaf pine, loblolly pine, and white oak) in an oak-hickory forest in North Carolina were evaluated. Because of branching patterns and bark characteristics, stemflow varied widely. Beech produced the most stemflow, then hickories; interception loss was greatest with beech trees. Only under hickory and beech did stemflow conduct much water to the forest floor. Chemical analysis of stemflow and throughfall showed that more calcium and potassium were returned to soil, followed by magnesium and manganese. Nutrients were always higher in stemflow, but total nutrient returns were greater in throughfall because more water reached the soil. On a crown-area basis, beeches contributed the least calcium and potassium, loblolly pines the most calcium, and hickories the most potassium. Stemflow and throughfall pH values were lowest in pine and highest in hickories. Soil nutrient patterns near trees were related to stemflow distribution and nutrient content of the several species. Soil potassium under hardwoods was higher in the stemflow absorption zone than under the crown edge. Soil calcium was higher near hickory and oak trunks. (See alo W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10326

CATION FLUX IN HARDWOOD AND WHITE PINE WATERSHEDS,
Georgia Univ., Athens. Dept. of Botany.
G. R. Best, and C. D. Monk.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 847-861. 1 fig., 2 tab., 36 ref. NSF AG-199,40-193-69.

Descriptors: *Cycling nutrients, *Cations, *Hardwood, *White pine trees, Calcium, Magnesium, Potassium, Sodium, Forests, Rainfall, North Carolina, Precipitation(Atmospheric), Input-output analysis, Throughfall, Litter, Percolation, Forest soils, Leaching, Runoff.
Identifiers: Coweeta hydrologic laboratory(NC).

Flux of selected dissolved cations (potassium, sodium, calcium, magnesium) through various levels of a forest from input of ions in rainfall to output of ions from the watershed in stream discharge was followed in a mature hardwood forest and an eastern white pine plantation in the Coweeta Hydrologic Laboratory, North Carolina. Nutrient concentrations were determined in precipitation input, throughfall, litter flow through, soil percolation, and stream discharge. Nutrient flux was determined from concentration and volume measurements. Amounts of water passing through various forest ecosystem levels changed markedly from input to output. Cation leaching from vegetation showed seasonal changes; potassium, calcium, and magnesium leaching was lower during winter months and increased with start of spring growth. Most potassium was leached from leaves before leaf fall, but most calcium and magnesium losses occurred after leaf fall. A summer reduction of sodium in throughfall was observed in the white pines. Total leachate loss from vegetation was highest for potassium and lowest for sodium; magnesium and calcium losses were intermediate. When water became streamflow discharge, the cation load was similar to its original input level, indicating that the ecosystem was able to minimize external loss while maintaining a large internal flux. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10329

ACUTE TOXICITY OF SODIUM CHLORIDE, PENTACHLOROPHENOL, GUTHION(R), AND HEXAVALENT CHROMIUM TO FATHEAD MINNOWS (PIMEPHALES PROMELAS) AND GOLDFISH (CARASSIUS AURATUS),
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
For primary bibliographic entry see Field 5C.
W76-10335

INCORPORATION OF 203HG INTO METHYLMERCURY IN FISH LIVER: STUDIES IN BIOCHEMICAL MECHANISMS IN VITRO,
Wisconsin Univ., Madison. Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W76-10347

DEEP-SEA BACTERIA: GROWTH AND UTILIZATION OF HYDROCARBONS AT AMBIENT AND IN SITU PRESSURE,
Maryland Univ., College Park. Dept. of Microbiology.
J. R. Schwarz, J. D. Walker, and R. R. Colwell.
Available from the National Technical Information Service, Springfield, Va 22161, as AD-A005 248, $3.50 in paper copy, $2.25 in microfiche. Applied Microbiology, Vol. 28, No. 6, p. 982-986, December, 1974. 3 tab., 1 fig., 12 ref.

Descriptors: *Atlantic Ocean, *Aquatic microorganisms, Oil, *Oil spills, Degradation(Decomposition), Deep water, Pressure, *Hydrostatic pressure, Sediments, Water pollution, Analytical techniques, Microbiology, Oil pollution, Growth, Waste disposal, *Biodegradation, *Bacteria.
Identifiers: n-hexadecane.

Microorganisms present in Atlantic Ocean sediment samples collected at a depth of 4,940 m were capable of utilizing hydrocarbons under both ambient and in situ pressures. The rate of utilization under in situ pressure (500 atm) and ambient temperature (20 C) was significantly less compared with hydrocarbon utilization examined under conditions of ambient temperature (20 C) and pressure (1 atm). (Katz)
W76-10349

MICROBIAL PETROLEUM DEGRADATION: USE OF MIXED HYDROCARBON SUBSTRATES,
Maryland Univ., College Park. Dept. of Microbiology.
J. D. Walker, and R. R. Colwell.
Available from the National Technical Information Service, Springfield, Va., 22161, as AD-A005 249, $3.50 in paper copy, $2.25 in microfiche. Applied Microbiology, Vol. 27, No. 6, p. 1053-1060, June, 1974, 4 fig., 7 tab., 14 ref.

Descriptors: *Water pollution sources, *Aquatic microorganisms, Oil, *Oil pollution, *Degradation(Decomposition), *Microbial degradation, *Chromatography, Analytical technology, Laboratory tests, Microbiology, Oil spills, Oil industry, Waste disposal, *Pollutant identification.
Identifiers: Gas-liquid chromatography, Model petroleum.

Methods of examining hydrocarbons to estimate the microbial degradation of petroleum are compared. Gas liquid chromatography with a mixed hydrocarbon substrate has been shown to be useful in evaluating microbial potential for degradation of a number of hydrocarbons. (Katz)
W76-10350

PROCEEDINGS OF THE CONFERENCE ON MARINE BIOLOGY IN ENVIRONMENTAL PROTECTION HELD AT SAN CLEMENTE ISLAND, CALIFORNIA ON 13-15 NOVEMBER, 1973.
Naval Undersea Center, San Diego, Calif.
For primary bibliographic entry see Field 5C.
W76-10353

THE FOULING COMMUNITY AS A FIELD MONITORING TECHNIQUE,
Naval Ship Research and Development Center, Annapolis, Md.
For primary bibliographic entry see Field 5C.
W76-10354

CHEMICAL PROBLEMS ENCOUNTERED IN TOXICITY STUDIES,
Naval Ship Research and Development Center, Annapolis, Md.
W. B. Mercer.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California, on 13-15 November, 1973, December, 1974, p 125-138. 7 fig, 8 ref.

Descriptors: *Toxicity, *Bioassays, Water quality, *Metals, *Chelation, Chemical analysis, Pollutant identification, Water analysis, Solubility, Acidity, Bonding, Salinity, Water chemistry, Laboratory tests, Ions.
Identifiers: Free metal ions, Metal concentration, Tissue concentration, Complexation.

Divalent metal ions interact with the anions normally observed in natural waters. As a result, the concentration of free metal ions in a test solution made with these waters is markedly lower than the quantity added would lead one to expect. This leads to uncertainty regarding the identity and physical state of the causative agent of the observed response. Laboratory determination of metal concentration in natural waters and in marine animal tissue requires careful choice of analytical method and meticulous attention to detail in preparative method. (See also W76-10353) (Katz)
W76-10364

MARINE POLLUTION MONITORING (PETROLEUM). PROCEEDINGS OF A SYMPOSIUM AND WORKSHOP,
National Oceanographic and Atmospheric Administration, Rockville, Md.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price $3.90. Department of Commerce, National Bureau of Standards, Special Publication 409, (December,1974). 316 p. Held at National Bureau of Standards, Gaithersburg, Md. May 13-17, 1974. R. C. Junghaus, Conference Coordinator.

Descriptors: *Analytical methods, *Oil spills, *Oil industry, Oil wastes, Data transmission, International waters, Water pollution, Water quality sampling, Monitoring, *Data collection, *Conferences.
Identifiers: *Marine pollution, Petroleum hydrocarbon measurement, Oil slicks, Tar balls.

These proceedings contain the invited plenary lectures representing pertinent scientific, environmental, and regulatory aspects of petroleum hydrocarbon measurements, the summaries of the contributed papers, dealing with specific scientific developments and recommendations, and the report of an international workshop which provides specific recommendations for the initiation of a coordinated Pilot Project for marine pollution (petroleum) monitoring. (See W76-10371 thru W76-10413) (Katz)
W76-10370

UNITED NATIONS ENVIRONMENT PROGRAM EARTHWATCH AND MARINE POLLUTION,
National Oceanic and Atmospheric Administration, Rockville, Md.
R. M. White.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum) Proceedings of a Symposium and Workshop, December, 1974, p. 3-7.

Descriptors: *International waters, Water pollution, Monitoring, Data collections, Water pollution Control, Federal government, United Nations.
Identifiers: *Marine pollution, *Earth watch.

The United Nations environment program realized the importance of monitoring ocean pollution and established monitoring as one of the seven major goals of the Global Environmental Monitoring System. It is hoped that the Intergovernmental Oceanographic Commission and the World Meteorological Organization, through the Integrated Global Ocean Station System (IGOSS) will be able to translate this general concern into a working international effort. (See also W76-10370) (Katz)
W76-10371

SCIENTIFIC PROBLEMS OF THE SYSTEMS FOR GLOBAL MONITORING AND INVESTIGATION OF OIL POLLUTION IN THE WORLD OCEAN,
State Oceanographic Inst., Moscow (USSR).
A. I. Simonov.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum). Proceedings of A Symposium and Workshop, December, 1974, p. 9-14.

Descriptors: *Hydrodynamics, *Dispersion, Oil pollution, Monitoring, International waters, Data collections, Oil wastes, Atlantic Ocean, Degradation(Decomposition).
Identifiers: Global monitoring, Marine pollution.

Discussion is presented of: (1) a continuous and systematic monitoring and evaluation of oil and oil product pollution conditions in the waters of the world oceans, (2) studies of the increasing utilization of oil and oil products as these uses affect the sea (3) the development of regulations concerning the discharge of substances containing petroleum originated hydrocarbons into the sea. (See also W76-10370) (Katz)
W76-10372

PILOT PROJECT ON MARINE POLLUTION MONITORING UNDER THE FRAMEWORK OF IGOSS,
Intergovernmental Oceanographic Commission, Paris (France).
A. Tolkachev.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum). Proceedings of a Symposium and Workshop, December, 1974, p. 21-26.

Descriptors: *Monitoring, *Oil pollution, *Oil spills, Water pollution, Data transmission, International waters, Water quality, Sampling, Data collections, Pilot plants, Oily waters, Oceanography.
Identifiers: *Marine pollution.

The International Oceanographic Commission (IOC) emphasizes the need to undertake specific studies of various aspects of marine pollution and recommends specific action to achieve these goals. The outlines of a pilot project on marine pollution monitoring is presented. (See also W76-10370) (Katz)
W76-10373

SURVEY ANALYSES FOR PETROLEUM DERIVED HYDROCARBONS IN THE OCEAN,
Maritime Safety Agency, Tokyo (Japan). Oceanographic Div.
S. Hori.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum). Proceedings of a Symposium and Workshop, p. 27-28.

Descriptors: Oil pollution, *Water pollution, *Water chemistry, *Analytical techniques, Monitoring, Oily water, Oil spills, Indian Ocean, Pacific Ocean, Surveys.
Identifiers: *Japan, Petroleum residues, Tokyo Bay, Marine sampling, *Marine pollution.

Fisheries training ships or fisheries research vessels collect samples for petroleum analyses as part of their operations. The Hydrographic Department of the (Japanese) Maritime Safety Agency conducts chemical analyses to study the present level of marine oil pollution. (See also W76-10370) (Katz)
W76-10374

MARITIME CONSIDERATION OF OIL TRANSPORTATION,
Maritime Administration, Washington, D. C.

For primary bibliographic entry see Field 5G.
W76-10375

MARINE POLLUTION DATA ARCHIVING AND EXCHANGE,
National Oceanic and Atmospheric Administration, Silver Spring, Md. Environmental Data Service.
For primary bibliographic entry see Field 5A.
W76-10376

MARITIME CONSIDERATIONS,
Maritime Administration Washington, D.C.
For primary bibliographic entry see Field 5G.
W76-10377

QUANTITATIVE MONITORING AND VARIABILITY OF PELAGIC TAR IN THE NORTH ATLANTIC,
Harvard University, Cambridge, Mass. Dept. of Engineering and Applied Physics.
J. N. Butler, and B. F. Morris.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum). Proceedings of a Symposium and Workshop, December, 1974. p. 75-78, 6 fig., 13 ref.

Descriptors: *Sampling, *Floating plants, Atlantic Ocean, Statistical analysis, Homogeneity, On-site data collections, Oil pollution, Oil spills, Plankton nets, Aquatic algae, Marine plants, *Monitoring.
Identifiers: *Sargassum, *Pelagic tar, *Tar, *Neuston, Oil residues, Bermuda, Sargasso Sea, Tar analysis, Marine pollution.

The variability of sampling by neuston net for either pelagic tar or Sargassum is very high, and even the results of successive tows may differ by a factor of ten. The standard deviation is of the order of 0.5 log units, a factor of 3. The standard deviation of the geometric mean of ten to fifteen neuston tows may be estimated to be approximately 0.15 log units, or 40%. In other words, a single neuston tow is representative of the general area where the tow is made only within a factor of ten. (See also W76-10370) (Katz)
W76-10378

TAR BALL LOADINGS ON GOLDEN BEACH, FLORIDA,
Coast Guard Research and Development Center, Groton, Conn.
W. A. Saner, and M. Curtis.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum). Proceedings of a Symposium and Workshop, December, 1974, p. 79-81, 3 fig.

Descriptors: *Atlantic Ocean, *Oil pollution, *Beaches, *Sands, Winds, *Florida, Sampling method, Statistical analysis, Intertidal area, Weather patterns.
Identifiers: Fort Lauderdale(Fla), Miami(Fla), Tar balls, Tar ball loadings, Beach sampling methods, Beach time constant, Beach bias.

Data from the sampling of beach tar from a sandy coast was performed for one year. The objective was to evaluate the effect of sampling zones of various sizes and the effects of tar build-up on the beach with time. The effect of wind on tar deposition was also determined. (See also W76-10370) (Katz)
W76-10379

TAR BALL SAMPLING IN THE WESTERN NORTH ATLANTIC,
Coast Guard Research and Development Center, Groton, Conn.
W. E. McGowen, W. A. Saner, and G. L. Hufford.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 83-84, 1 tab., 11 fig.

Descriptors: *Atlantic Ocean, *Sampling, Oil pollution, Analytical techniques, On-site investigations, Oily water.
Identifiers: Oil sampling techniques, Oil identification, Bravo, Charlie, Delta, Echo, Marine pollution.

The U. S. Coast Guard conducted a sampling program in the western North Atlantic Ocean beginning in 1971 to determine the quantity and source of floating tar 'balls' in the marine environment. Most of the sampling was performed from Coast Guard weather ships deployed at four ocean station sites: Bravo (56 degrees 30' N, 51 degrees 00' E), Charlie (52 degrees 45' N, 35 degrees 30' W), Delta (44 degrees 00' N, 41 degrees 00' W) and Echo (35 degrees 00' N, 48 degrees 00' W). The series sampling at each location allowed a determination of variability and estimation of the average amount of tar present. (See also W76-10370) (Katz)
W76-10380

EVALUATION OF THIN FILM OIL SAMPLERS,
Coast Guard, Washington, D.C.
For primary bibliographic entry see Field 5A.
W76-10381

OIL SPILLAGE MONITORING, SAMPLING AND RECOVERY SYSTEMS,
Durham Associates, Inc., Milford, N. H.
J. G. Zahka.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 89-90.

Descriptors: *Oil pollution, *Monitoring, Methodology, *Oily water, *Physicochemical properties, Physical properties, Water analysis, On-site data collections, *Sampling.
Identifiers: Oil detection, Oil sampling, Oil recovery, Selective membrane.

Products have been developed by Durham Associates, Inc. for use in controlling marine pollution from petroleum. They incorporate a unique selectivity transmissive membrane which, while preventing the penetration of water, allows oil to flow through easily. Modifications of this membrane have been used in the construction of oil spill detection systems, oil recovery devices, and surface oil samplers. (See also W76-10370) (Katz)
W76-10382

SAMPLING OF OIL SPILLS AND FINGERPRINTING BY INFRARED SPECTROSCOPY,
Rhode Island Univ., Kingston, Dept. of Chemistry.
C. W. Brown, M. Ahmadjian, and P. Lynch.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 91-92, 1 fig., 3 ref.

Descriptors: *Oily water, Methodology, *Monitoring, *Spectroscopy, Water pollution, Analytical methods, Oil spills, Chemical analysis, Water pollution sources, *Secondary recovery(Oil), Pollutant identification.
Identifiers: Infrared spectroscopy, Oil slick, Narragansett Bay(RI), Fingerprinting.

Infrared spectra of crude oils and their various distillates in the 650 to 1200 cm-1 region provide unique fingerprints, which can be used to identify the source of oil slicks. (See also W76-10370) (Katz)
W76-10383

MAPPING AND IDENTIFICATION OF OIL ON WATER BY THE USE OF AN AIRBORNE LASER SYSTEM,
National Aeronautics and Space Administration, Wallops Island, Va. Wallops Station.
G. K. Schwemmer, and H. H. Kim.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 95-96, 5 fig., 3 ref.

Descriptors: *Remote sensing, *Aerial reconnaissance, *Analytical techniques, Oily water, *Oil spills, *Aircraft, Methodology, *Photometry, *Oil pollution, Mapping, *Pollutant identification, Path of pollutants.
Identifiers: Oil on water, *Airborne laser system, Airborne laser sensor, Laser, Laser induced emission.

Airborne laser oil fluorosensor systems have been test flown both here and elsewhere for the detection of oil on water. Recently there has been increased interest in developing an advanced model which not only detects but also performs a broad classification of the target oils according to their grades. (See also W76-10370) (Katz)
W76-10384

MOVEMENT OF SPILLED OIL IN SAN FRANCISCO BAY AS PREDICTED BY ESTUARINE NONTIDAL DRIFT,
Geological Survey, Menlo Park, Calif.
T. J. Conomos.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 97-100, 5 fig., 16 ref.

Descriptors: *Oily water, *Aquatic drift, *Water currents, *Oil pollution, Estuarine environment, Straits, *Oil spills, California, *Path of pollutants, Bays, Forecasting.
Identifiers: Estuarine water circulation, Non-tidal drift, Sea bed drifters, Surface drifters, *San Francisco Bay, Continental shelf.

From March 1970 through April 1973, the U.S. Geological Survey released surface and seabed drifters every 2 months within San Francisco Bay and on the continental shelf of central California as a part of a study of seasonal nontidal drift patterns in the Bay. One of the routine release points was located at the site of a major oil spill which occurred on 18 January 1971 when two oil tankers collided at Golden Gate, San Francisco Bay, California. Approximately 3200 m3 (26,700 barrels) of Bunker C fuel oil spilled into the bay. Marked similarities between the drift patterns of the spilled oil and that of both the surface and seabed drifters became immediately obvious. These similarities, together with 3 years of data from the drifter study made it possible to predict the movement of spilled oil. (See also W76-10370) (Katz)
W76-10385

OIL POLLUTION ALONG THE INDIAN COASTLINE,
National Inst. of Oceanography, Panjim (India).
S. N. Dwivedi, and A. H. Parulekar.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workship, December, 1974. p. 101-105, 2 tab., 4 fig., 3 ref.

Descriptors: *Oil pollution, *Indian Ocean, Beaches, Marine algae, Polychaetes, *Oil spills, *Deposition(Sediments).
Identifiers: Tar balls, Tide levels, Rhozopora fruits, Physalia, Degradation products, Marine pollution.

Oil in the form of tar balls is washed ashore along the Indian beaches. These were first noticed in 1970. From 1971 to 1973, studies were undertaken along both east and the west coasts of India to determine the areas, seasons, and the intensity of deposition of tar balls and their possible origin. The size of the tar balls, places and seasons of deposition vary a great deal. Therefore, for com-

parison of data from selected beaches, duplicate samples were collected from 0.1 m2 surface at supra, high, mid and low tide marks and the weight of tar balls was determined and expressed as g/m2. (See also W76-10370) (Katz)
W76-10386

SAMPLING ERRORS IN THE QUANTIFICATION OF PETROLEUM IN BOSTON HARBOR WATER,
Massachusetts Inst. of Technology, Cambridge. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5A.
W76-10387

HYDROCARBON CONCENTRATIONS IN SEAWATER ALONG THE HALIFAX-BERMUDA SECTION: LESSONS LEARNED REGARDING SAMPLING AND SOME RESULTS,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 5A.
W76-10388

HYDROCARBON CONTENT AND CHLOROPHYLL CORRELATION IN THE WATERS BETWEEN NOVA SCOTIA AND THE GULF STREAM,
Bermuda Biological Station for Research, St. George's West.
A. Zsolnay.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workship, December, 1974, p. 255-256, 9 ref.

Descriptors: *Atlantic Ocean, *Organic compounds, *Water quality, *Chlorophyll, Laboratory studies, Statistical analyses, Chemical analysis, *Canada, Eutrophication.
Identifiers: Euphotic zone, Nova Scotia, Gulf Stream, *Biogenic hydrocarbons.

Studies have indicated that a casual relationship exists between the hydrocarbon and chlorophyll concentration of the euphotic zones of the Atlantic between Nova Scotia and the Gulf Stream. One cannot assume, however, that phytoplankton are the sole source of this material. (See also W76-10370) (Katz)
W76-10389

DETERMINATION OF AROMATIC HYDROCARBONS IN SEA WATER USING AN ELECTROLYTIC STRIPPING CELL,
National Bureau of Standards, Washington, D.C., Inst. for Materials Research.
For primary bibliographic entry see Field 5A.
W76-10390

DETERMINATION OF AROMATIC AND TOTAL HYDROCARBON CONTENT IN SUBMICROGRAM AND MICROGRAM QUANTITIES IN AQUEOUS SYSTEMS BY MEANS OF HIGH PERFORMANCE LIQUID CHROMATOGRAPHY,
Bermuda Biological Station for Research, St. George's West.
For primary bibliographic entry see Field 5A.
W76-10391

DETERMINATION OF C1-C10 HYDROCARBONS IN WATER,
Chevron Oil Field Research Co., La Habra, Calif.
For primary bibliographic entry see Field 5A.
W76-10392

SUSPENSIONS OF CRUDE OILS IN SEA WATER: RAPID METHODS OF CHARACTERIZING LIGHT HYDROCARBON SOLUTES,
Battelle Pacific Northwest Labs., Richland, Wash. Ecosystems Dept.
For primary bibliographic entry see Field 5A.
W76-10393

MEASUREMENT AND CHARACTERIZATION OF NONVOLATILE HYDROCARBONS IN OCEAN WATER,
Exxon Research and Engineering Co., Linden, N. J.
R. A. Brown, J. J. Elliott, and T. D. Searl.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p 131-135, 2 tab, 2 fig, 2 ref.

Descriptors: *Chromatography, *Oily water, Oil pollution, Methodology, Analytical techniques, Water quality, Gas chromatography, Transportation, Ships, Marine water, *Pollutant identification.
Identifiers: Hydrocarbons, Tanker routes, Lipids, Hydrocarbon measurements, Lipid measurements.

A method is described for the measurement and characterization of nonvolatile hydrocarbons, (C-14 and heavier) in ocean water. The method was applied to total dispersed hydrocarbons which generally occur in the concentration range, 0-20 ppb (wt.). (See also W76-10370) (Katz)
W76-10394

IDENTIFICATION, ESTIMATION AND MONITORING OF PETROLEUM IN MARINE WATERS BY LUMINESCENCE METHODS,
Baird-Atomic, Inc., Bedford, Mass.
A. W. Mornig.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p 135-144, 14 fig, 20 ref.

Descriptors: Analytical techniques, *Waste identification, *Spectroscopy, *Fluorescense, Oil pollution, Oily water, Methodology, Remote sensing, Tracers, Water pollution, *Monitoring, *Pollutant identification.
Identifiers: Oil classification, Oil fluoresence, Oil identification, Low temperature luminescence, Molecular luminescence, Phosphorescence, Total luminescence, Spectroscopy.

Fluorescence analysis is more sensitive and less subject to interference than the simple absorbance method and is therefore superior, especially when the concentration of residual oils in the sea water are less than 10 ppb. Luminescence offers a specific and sensitive method for the study of oil in water. (See also W76-10370) (Katz)
W76-10395

RECENT DEVELOPMENTS IN THE IDENTIFICATION OF ASPHALTS AND OTHER PETROLEUM PRODUCTS,
Environmental Protection Agency, Cincinnati, Ohio.
For primary bibliographic entry see Field 5A.
W76-10396

IDENTIFICATION OF HYDROCARBONS IN AN EXTRACT FROM ESTUARINE WATER ACCOMODATED NO. 2 FUEL OIL,
Virginia Inst. of Marine Sciences, Gloucester Point. Environmental Chemistry Section.
For primary bibliographic entry see Field 5A.
W76-10397

ANALYSES OF HYDROCARBONS IN MARINE ORGANISMS: RESULTS OF IDOE INTERCALIBRATION EXERCISES,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 5A.
W76-10398

IDOE-5 INTERCALIBRATION SAMPLE: RESULTS OF ANALYSIS AFTER SIXTEEN MONTHS STORAGE,
Woods Hole Oceanographic Institution, Mass. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W76-10399

USE OF LOW MOLECULAR-WEIGHT-HYDROCARBON CONCENTRATIONS AS INDICATORS OF MARINE POLLUTION,
Texas A and M Univ. College Station, Dept. of Oceanography.
W. M. Sackett, and J. M. Brooks.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 171-173, 1 fig., 5 ref.

Descriptors: *Oily water, *Oil pollution, *Gulf of Mexico, Indicators, Marine organisms, Environmental effects, Industrial wastes, Path of pollutants, Pollutant identification, Water quality, *Bioindicators.
Identifiers: *Hydrocarbon sniffer, *Low-Molecular-Weight hydrocarbons, *Pollution indicators, Petroleum production platforms, Dissolved ethane, Exposed well heads, *Marine pollution.

Large areas of coastal water offshore Texas and Louisiana have up to six orders of magnitude higher concentrations of low-molecular-weight hydrocarbons than open ocean surface water. These high levels are most certainly petroleum-derived and due to offshore petroleum production operations. The observed high levels of C1 to C3 hydrocarbons do not seem to be detrimental to marine life, but nevertheless serve as sensitive indicators of the more toxic components of petroleum which usually are being simultaneously introduced to the ocean. (See also W76-10370) (Katz)
W76-10400

SAMPLING MARINE ORGANISMS AND SEDIMENTS FOR HIGH PRECISION GAS CHROMATOGRAPHIC ANALYSIS OF AROMATIC HYDROCARBONS,
National Marine Fisheries Service, Auke Bay, Alaska. Auke Bay Fisheries Lab.
For primary bibliographic entry see Field 5A.
W76-10401

FIELD SAMPLING METHODS AND TECHNIQUES FOR MARINE ORGANISMS AND SEDIMENTS,
University of Southern California, Los Angeles. Allan Hancock Foundation.
For primary bibliographic entry see Field 5A.
W76-10402

METHODS FOR ESTABLISHING LEVELS OF PETROLEUM CONTAMINATION IN ORGANISMS AND SEDIMENT AS RELATED TO MARINE POLLUTION MONITORING,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
R. C. Clark, Jr.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974. p. 189-194, 5 tab., 2 fig., 15 ref.

Descriptors: Methodology, *Monitoring, *Sampling, *Gas chromatography, *Sediments, *International waters, Oily waters, Oil pollution, Analytical techniques, Spectrometry, On-the-site investigations, Statistical analysis, Marine animals.
Identifiers: Paraffin residual patterns, Petroleum contamination, Marine pollution monitoring.

In order to plan a global pollution monitoring program for petroleum, it is necessary to standardize

sample collection, preservation and preparation of samples. It is necessary to standardize extractive and chromatographic procedures and data reduction techniques so that the resulting data are compatible worldwide. (See also W76-10370) (Katz)
W76-10403

QUANTITATIVE DETERMINATION OF HYDROCARBONS IN MARINE ORGANISMS,
Battelle Columbus Labs., Ohio.
For primary bibliographic entry see Field 5A.
W76-10404

LONG TERM WEATHERING CHARACTERISTICS OF IRANIAN CRUDE OIL: THE WRECK OF THE 'NORTHERN GULF',
Bowdoin Coll., Brunswick, Maine. Dept. of Chemistry.
D. W. Mayo, D. J. Donovan, and L. Jiang.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974. p. 201-208, 3 tab., 4 fig., 6 ref.

Descriptors: *Oil pollution, *Mollusks, *Sediments, *Gas chromatography, *Oil spill, *Experimental animals, *Toxicity, Atlantic Ocean, Environmental effects, Weathering, Bioassay, Maine, Analytical techniques, Marine animals.
Identifiers: *Scot columns, Isoprenoids, *Weathered oil, *Oil absorption, *Mya arenaria, *Iranian crude oil, *Penobscot Bay(Maine), Commercial shellfish, 'Northern Gulf' wreck, Marine pollution.

A study was instituted in the summer of 1972 to establish the present state of the hydrocarbon residues in the sediments and marine life of the area of lower Penobscot Bay affected by the Iranian crude oil resulting from the wreck of the Northern Gulf. Hydrocarbon sampling of experimental transplanted clams and controls indicated that there was a rapid absorption of hydrocarbon residues by the animals. (See also W76-10370) (Katz)
W76-10405

ANALYTICAL TECHNIQUES FOR ISOLATING AND QUANTIFYING PETROLEUM PARAFFIN HYDROCARBONS IN MARINE ORGANISMS,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
For primary bibliographic entry see Field 5A.
W76-10406

DETERMINATION OF HYDROCARBONS IN MARINE ORGANISMS AND SEDIMENTS BY THIN LAYER CHROMATOGRAPHY,
California Univ., Berkeley. Naval Biomedical Research Lab.
For primary bibliographic entry see Field 5A.
W76-10407

HYDROCARBONS IN BLUE MUSSELS FROM THE KIEL BIGHT,
Kiel Univ. (West Germany). Institut fuer Meereskunde.
M. Erhardt, and J. Heinemann.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 221-225, 1 tab., 6 fig., 5 ref.

Descriptors: *Benthic organisms, *Marine animals, *Mollusks, *Mussels, *Oil pollution, *Gas chromatography, *Waste identification, Oily water, Water quality, Mass spectrometry, On-site investigations, *Pollutant identification.
Identifiers: *Fossil hydrocarbon, *Tissue accumulation, *Hydrocarbon exchange, *Biogenic hydrocarbons, Degrading hydrocarbons.

Blue mussels (Mytilus edulis) from a location in the Kiel Bight, contain fossil hydrocarbons in concentrations somewhat above the natural background of recent biogenic hydrocarbons. The composition of the hydrocarbon fraction is not constant. Mussels collected after the spring phytoplankton bloom contain relatively large amounts of recent biogenic hydrocarbons whose concentrations in mussels collected in January are quite low. On the other hand, concentrations of cycloalkanes, mono-, di-, and tri-aromatics as well as mixed types of fossil origin have a tendency to rise. (See also W76-10370) (Katz)
W76-10408

PELAGIC TAR IN THE GULF OF MEXICO AND CARIBBEAN SEA,
Texas A and M Univ., College Station. Dept. of Oceanography.
L. M. Jeffrey, W. E. Pequegnat, E. A. Kennedy, A. Vos, and B. M. James.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974. p. 233-235, 1 tab., 3 fig., 3 ref.

Descriptors: *Oil pollution,1 *Oil-water interfaces, Ships, *Gulf of Mexico, Waste identification, Transportation, Organic compounds, *Pollutant identification.
Identifiers: Gulf Stream, *Pelagic tar, Tar balls, *Caribbean Sea, Sulfur or tar balls, Asphaltene of tar balls, Marine pollution.

The Gulf of Mexico apparently has less pelagic tar than the Mediterranean and Sargasso Sea, but more than the Caribbean and northeast Pacific but about the same amount as the Gulf Stream. Some of the pelagic tar is swept into the Gulf of Mexico through the Yucatan Straits and out through Florida Straits and is derived primarily from shipping and tanker cleaning operations. Specific sources are difficult to ascertain of these obviously weathered materials, so a multi-parameter approach is necessary. See also W76-10370) (Katz)
W76-10409

DISTRIBUTION OF TAR BALLS AND NEUSTON SAMPLING IN THE GULF STREAM SYSTEM,
National Marine Fisheries Service, Narragansett, R. I. Narragansett Lab.
K. Sherman, J. B. Colton, R. L. Dryfoos, K. D. Knapp, and B. S. Kinnear.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 243-244. 1 fig., 1 tab., 7 ref.

Descriptors: *Oil pollution, *Environmental effects, *Reproduction, *Plankton, *Marine organisms, *Juvenile fish, Atlantic Ocean, Aquatic productivity, Marine fish, Fish eggs, Oily water, *Sampling, Distribution.
Identifiers: *Neuston, MARMAP, *Tar balls, Gulf Stream, Tar ball distribution, Tar ball composition.

Significant amounts of tar balls were observed off the east coast of the United States during surveys of larval fishes and their environment in the summer of 1972 and winter of 1973. The effect of petroleum residues on marine productivity is unclear. (See also W76-10370) (Katz)
W76-10410

EFFECTS OF OILS ON BALTIC LITTORAL COMMUNITY, AS STUDIED IN AN OUTDOOR MODEL TEST SYSTEM,
Swedish Water and Air Pollution Research Lab., Studsvik (Sweden). Baltic Lab.
For primary bibliographic entry see Field 5C.
W76-10411

EFFECT OF AN OIL SPILL ON BENTHIC ANIMALS IN THE LOWER YORK RIVER, VIRGINIA,
Virginia Inst. of Marine Sciences, Gloucester Point. Div. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5C.
W76-10412

MARINE POLLUTION BY CARCINOGENIC HYDROCARBONS,
Center for Science in the Public Interest, Washington, D. C.
For primary bibliographic entry see Field 5C.
W76-10413

OHIO RIVER COOLING WATER STUDY,
Argonne National Lab., Ill.
For primary bibliographic entry see Field 5C.
W76-10414

SYMPOSIUM ON MODELING TECHNIQUES, VOLUME II.
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 8B.
W76-10415

TIME-DEPENDENT MASS DISPERSION IN NATURAL STREAMS,
Dames and Moore, Bethesda, Md.
F. M. Holly, Jr., and J. A. Cunge.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1121-1137, 1975. 7 fig, 12 ref.

Descriptors: *Model studies, *Streams, *Dispersion, *Diffusion, Mathematical models, Rivers, Mass transfer, Water pollution, Pollutants, *Path of pollutants, Water quality, Computer models, *Virginia.
Identifiers: *Finite difference model, *Clinch River(Va).

A finite-difference model for the prediction of time-dependent mass dispersion in steady but nonuniform river flow was presented. Specific attention was devoted to problems of convergence in the computation of convection. The model is non-diffusive and unconditionally stable, and is applicable to mixing from sources of arbitrary configuration. Application of the model to field measurements of one-dimensional mixing in Clinch River, Virginia, demonstrated its ability to provide good estimates of dispersion using relatively little computer time and with minimum calibration. (See also W76-10415) (Sims-ISWS)
W76-10436

SCALING AND SIZING CRITERIA FOR THERMAL-HYDRAULIC MODELS,
Acres Consulting Services Ltd., Niagara Falls (Ontario).
S. T. Lavender, and J. E. Cowley.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1156-1164, 1975. 4 ref, 1 append.

Descriptors: *Model studies, *Thermal pollution, *Thermal powerplants, Hydraulic models, Powerplants, Diffusion, Dispersion, Jets, Buoyancy, Mass transfer, Cooling, Cooling water, Hydraulics.
Identifiers: *Model scaling, Boundary influence.

The principles of scaling for models of heated water flows have been expounded by a number of

authors. These fall short of defining explicit requirements for scale and boundary selection for a specific model. Criteria which recognize established principles and which have been applied in choosing scales and model sizes for several very large thermal-hydraulic models were presented. (See also W76-10415) (Sims-ISWS)
W76-10437

APPLICATION OF A WATER QUALITY MODEL TO THE DENVER METROPOLITAN AREA,
Black and Veatch, Denver, Colo.
V. P. Soice.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1165-1182, 1975. 9 fig, 1 tab, 3 ref.

Descriptors: *Model studies, *Urban hydrology, *Water quality, *Colorado, Mathematical models, Computer models, Water pollution, Pollutants, Streams, Rivers, Urban runoff, Urban drainage, Watersheds(Basins), Rainfall.
Identifiers: *Denver(Colo).

The utilization of sophisticated digital computer models for analyzing alternative wastewater treatment systems is a relatively recent innovation in water resources engineering. Because of the complexity of the stream system and water use patterns in the Denver Metropolitan area, full dynamic simulation of water quantity and quality was utilized in a study of regional water quality management. Complicating water quality and quantity factors and a desire to effect a regional approach to management of the region's quality resulted in selection of the hydrologic and water quality programming packages offered by Hydrocomp International, Palo Alto, California. The model as adapted to the Denver area is known as the Hydro-Quality Model and is characterized as a nonuniform, unsteady state model that provides continuous dynamic simulation of water quality and quantity constituents. The model was calibrated utilizing an extensive meteorological data base, adjusting basin parameters to produce simulated stream flow and water quality and comparing this result with historically recorded values. A satisfactory calibration achieved, the model was utilized as an analytical tool to determine through simulation the resultant water quality in the stream network under various alternative wastewater management systems. Model results for the various alternatives were compared against one another and against predetermined water quality goals. This paper discussed the procedures utilized in applying this particular model and evaluated its effectiveness as a tool to manage regional water quality. (See also W76-10415) (Sims-ISWS)
W76-10438

COMBINED USE OF PHYSICAL AND MATHEMATICAL MODELS FOR ANALYSIS OF RESERVOIR WATER QUALITY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
J. P. Bohan, and B. Loftis.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1183-1195, 1975. 3 fig, 10 ref.

Descriptors: *Model studies, *Water quality, *Hydraulic models, *Mathematical models, Reservoirs, Heat transfer, Dissolved oxygen, Biochemical oxygen demand, Discharge(Water), Withdrawal, Inflow, Mixing, Water circulation, Pollutants, Path of pollutants, Water pollution, Analytical techniques.

Numerical simulation models for predicting reservoir water quality have emerged rapidly during the past few years. Unfortunately, the description in these models of the hydrodynamics of a density stratified reservoir has not progressed as rapidly as the need to predict water quality. This paper described the concepts of the numerical simulation model and the use of the physical models to improve the mathematical descriptions. An accurate determination of reservoir water quality is dependent upon the ability to describe water movement through a reservoir and account for retention times of various layers. The physical model provides a means of determining this information. The information gained from the physical model can be used to modify the mathematical model. Entrainment currents, exchanges between layers, inflow placement and distribution, currents created by withdrawal, and travel times can be accounted for satisfactorily in a one-dimensional reservoir simulation model. This technique provides a more accurate description of the water budget which contributes to the accuracy of the water quality predictions. (See also W76-10415) (Sims-ISWS)
W76-10439

APPLICATION OF A DYNAMIC NETWORK MODEL TO HYDRAULIC AND WATER QUALITY STUDIES OF THE ST. LAWRENCE RIVER,
M. L. Thatcher, H. W. Pearson, and R. E. Mayor-Mora.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1196-1219, 1975. 15 fig, 4 tab, 9 ref.

Descriptors: *Model studies, *Water quality, *St Lawrence River, *Mathematical models, Hydrodynamics, Hydraulics, Pollutants, Path of pollutants, Nutrients, Dissolved oxygen, Biochemical oxygen demand, Coliforms, Zooplankton, Phytoplankton, Inflow, Discharge(Water), Water levels, Rivers, Water quality control.

A network-type numerical model of hydraulics and water quality has been implemented to provide predictive capability in the study of the St. Lawrence River from Cornwall, Ontario, past Montreal and downstream into the tidal region as far as Montmagny, Quebec. The M.I.T. Dynamic Network Model was adopted for this study. It consists of a coupled solution to the governing equations of transient hydraulics and mass transport for a network of one-dimensional reaches of variable cross-sectional area. Modifications were made to the original model to adapt it for ice cover, to provide for continuity across control structures, and to include additional water quality parameters including an interactive nutrient model. Verification was made to steady-state conditions in the non-tidal region and to transient conditions in the tidal region. The model represents a management tool for predicting the results of different hydraulic and water quality conditions. These conditions can be natural ones such as floods, icing, storm tides and storm water runoff, or they can be related to human activity such as dam regulation, changes in river geometry, degrees of waste water treatment, and the location of outfalls. (See also W76-10415) (Sims-ISWS)
W76-10440

FINITE DIFFERENCE APPROXIMATION TO THE CONVECTIVE TRANSPORT EQUATION,
Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
R. B. Gordon, and M. L. Spaulding.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1220-1236, 1975. 12 fig, 1 tab, 8 ref.

Descriptors: *Model studies, *Water quality, *Path of pollutants, Water pollution, Rivers, Liquid wastes, Pollutants, Convection, Mathematical models, Mathematics, Equations, Analytical techniques, Massachusetts.
Identifiers: Charles River(Mass).

A rapidly converging, implicit finite difference approximation to the steady, one-dimensional convective transport equation has been developed. A mathematical analysis of the dispersive and dissipative characteristics of the finite difference approximatio for the linear case has been conducted, as well as numerical experiments to study accuracy and convergence rate as a function of dispersion coefficient, velocity, and grid spacing. The purpose of this study has been to make available a numerical solution of steady, convective transport problems that will use a minimum of computer time and storage so as to be economical enough to be readily used in water quality studies. Guidelines for the most efficient use of the model were suggested, and the results of an application to the distribution of phosphorous in the Charles River was included. (See also W76-10415) (Sims-ISWS)
W76-10441

SIMULATION OF THE SALINITY DISTRIBUTION IN THE ST. LAWRENCE ESTUARY BY A TWO-DIMENSIONAL MATHEMATICAL MODEL,
Laval Univ., Quebec. Dept. of Civil Engineering.
Y. Ouellet, and J. Cerceau.
In: Symposium On Nodeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1249-1269, 1975. 13 fig, 19 ref.

Descriptors: *Model studies, *Estuaries, St. Lawrence River, Mathematical models, *Salinity, Freshwater, Sea water, Temperature, Saline water-freshwater interfaces, Sediments, Erosion, Hydrodynamics, Tides, Water levels, Water circulation.
Identifiers: *St. Lawrence estuary.

The estuary of the St. Lawrence River is a large fluvio-maritime complex extending from the Gulf of St. Lawrence to Montreal. This system is subdivided into the maritime estuary, the lower estuary of a length of approximately 150 miles characterized by great depths (of the order of 1000 ft or more), by a stratification of saline waters and by a width varying from 15 to 30 miles, and the fresh water estuary, the upper estuary of a length of approximately 100 miles where there exist only fresh water tides. In between, the fresh water from upland sources mixes with saline waters from the Atlantic Ocean. This is the region of interest for the present study. The knowledge of the salinity distribution in the estuary is important, considering the flocculation phenomena which are then indirectly related to sedimentation and water quality problerosion patterns with respect to salne and suspension concentrations. These phenomena depend also on the fresh water inflow and in a cycle way on tides. Two numerical models have been developed, a hydrodynamical model and a transport model, the former serving as support to the latter. It has thus been possible to obtain a better representation of the distribution of salinity concentration and to see the influence of the tide and Coriolis force on the penetration of salt water in the estuary. However, the two-dimensional approach has not made possible the differentiation between superficial fresh water flow and deep salt water flow, a most important aspect in sedimentation mechanisms. (See also W76-10415) (Sims-ISWS)
W76-10443

MODELLING OF SUSPENSION CURRENTS,
Trondheim Univ. (Norway). Vassdrags-og Havnelaboratoriet.
E. Tesaker.
In: Symposium on Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1385-1401, 1975. 7 fig, 9 ref.

Descriptors: *Model studies, *Sediment transport, *Deposition(Sediments), Mathematical models, Hydraulic models, Erosion, Sedimentation, Suspended solids, Mine wastes, Currents(Water), Jets, Fluid mechanics, Hydraulics, *Path of pollutants.

The transport and deposition of particles by suspension currents and jets were discussed. The paper described experience with the transfer of results from ideal laboratory studies to practical cases, and discussed the limitations of physical modelling of suspension currents. Model laws for density currents can be used as long as the particle fall velocity is small compared to the flow velocity. To model the particle motion, Lacey's rule for distortion of movable bed models must be fulfilled. Field measurements in a suspension current carrying mine waste have shown that the external flow mechanics of field and laboratory currents can be directly compared, even if full similarity is not satisfied. No presently known model technique can reproduce the internal density conditions of a field current with particles finer than sand, because of complex problems involved in scaling settling velocity and sediment diffusion. Models can be used to compare alternative solutions, however. A study of red mud discharge into deep water was described. A study of the coupling between fluid and the particles in a horizontal jet was described. Such information is useful for evaluation of scale effects due to distortion of partical diameters in models. The deposition patterns were compared with observed deposition of ore waste into a lake. (See also W76-10415) (Sims-ISWS)
W76-10449

TWO-DIMENSIONAL FINITE ELEMENT DISPERSION MODEL,
Dames and Moore, Cranford, N.J.
W. Leimkuhler, J. Connor, J. Wang, G. Christodoulou, and S. Sundgren.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1467-1486, 1975. 11 fig, 9 ref.

Descriptors: *Model studies, *Dispersion, *Finite element analysis, Mathematical models, Circulation, Water circulation, Bays, Sediments, Suspended solids, Pollutants, Path of pollutants, Massachusetts.
Identifiers: *Massachusetts Bay(Mass).

The development of a finite element model to solve the vertically integrated form of the convection-diffusion equation was described. The vertical integration of the governing equation reduces the problem to two dimensions. This limits the model's predictive capability in problems having high variation of velocity over depth. However, the greatly reduced storage and computation costs of this approach make it a worthwhile alternative to a full three-dimensional model. The Galerkin method with the linear weighting function was used in the finite element formulation. Variable depth was included in the arbitrarily shaped solution field. Along with the water body geometry, the model inputs required are water velocities, dispersion coefficients and decay factors at various points in the solution field. These values may be given as constants or as functions of space and time. The model was verified by comparison with several analytical solutions. The model was then applied to the dispersion of suspended sediments in Massachusetts Bay. A recently developed finite element circulation model was employed to generate velocities for the model. Certain stability problems that occasionally arise with the use of the model were discussed and techniques to avoid such problems were presented. (See also W76-10415) (Sims-ISWS)
W76-10453

EXCHANGE FLOW BETWEEN LAKE ONTARIO AND HAMILTON HARBOUR,
Canada Centre for Inland Waters,Burlington (Ontario).
T. M. Dick, and J. Marsalek.
Canada Centre for Inland Waters, Scientific Series No. 36, 1973, 22 p. 9 fig., 14 ref., 6 tab.

Descriptors: *Mixing, *Lake Ontario, Water level fluctuations, Density, Currents, Landfills, Operations, Water quality, *Canada, Industrial wastes, Lakes, Flow characteristics, Water pollution sources, *Path of pollutants.
Identifiers: *Hamilton Harbour(Ontario), Burlington Canal(Ontario), Industrial pollution, *Exchange flow(Lakes).

A hydraulic study of the exchange flow between Hamilton Harbour and Lake Ontario reveals the necessity to consider short term transitory water level fluctuations to estimate mass exchange. Field studies identified the development of a strong thermal wedge and density current which increases the mass exchange. Data on the thermal wedge were used to examine the two dimensional wedge theory. Some calculations were also done on the effect of harbour land filling on the mass exchange. (Environment Canada)
W76-10496

5C. Effects Of Pollution

HIGHWAY-WILDLIFE RELATIONSHIPS VOLUME 1. A STATE-OF-THE-ART REPORT,
Urban Wildlife Research Center, Inc., Ellicott City, Md.
For primary bibliographic entry see Field 4C.
W76-10003

HIGHWAY-WILDLIFE RELATIONSHIPS VOLUME 2. AN ANNOTATED BIBLIOGRAPHY,
Urban Wildlife Research Center, Inc., Ellicott City, Md.
For primary bibliographic entry see Field 4C.
W76-10004

SELECTIVE RENOVATION OF EUTROPHIC WASTES PHOSPHATE REMOVAL,
Consiglio Nazionale delle Ricerche, Bari (Italy). Instituto di Ricercha sulle Acque.
For primary bibliographic entry see Field 5D.
W76-10026

BIOLOGICAL SURVEY OF THE SAVANNAH RIVER IN THE VICINITY OF THE SAVANNAH RIVER PROJECT. PART I - REPORT ON THE WORK DONE AND TENTATIVE CONCLUSIONS ON THE SUMMER SURVEY,
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
J. E. Cole, R. R. Palmer, R. Patrick, and T. Dolan.
Available from the National Technical Information Service, Springfield, Va 22161 as TID-26669-P1, $4.00 in paper copy, $2.25 in microfiche. Report ACADOF-51-VSR, Pt. I, September 24, 1951. 28 p, 1 tab.

Descriptors: *South Carolina, Surface waters, *Sewage, *Water pollution, Flora, Aquatic fauna, *Aquatic microorganisms, *Biochemical oxygen demand, *Coliforms, *Georgia, Domestic wastes, Water pollution sources, Aquatic bacteria, On-the-site survey, Microbiology.
Identifiers: *Savannah River(SC-Geo), Upper Three Run, Augusta(Geo).

The Savannah River is a normal river of low biological productivity. This limited life is due to physical circumstances causing unfavorable ecological conditions rather than pollution. The only noticeable effects of pollution resulting from the Augusta sewage are the very high bacteria and coliform counts. Upper Three Run also shows a similar condition, which is probably due to the trailer camp and swimming area which is located at and just above the station. (See also W76-10042 and W76-10043) (Katz)
W76-10041

BIOLOGICAL SURVEY OF THE SAVANNAH RIVER IN THE VICINITY OF THE SAVANNAH RIVER PROJECT, PART II - REPORT ON WORK DONE AND TENTATIVE CONCLUSIONS ON THE FALL SURVEY,
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
F. L. Carter, T. Dolan, IV, G. McCammon, S. Roback, and J. H. Wallace.
Available from the National Technical Information Service, Springfield, Va 22161 as TID-26669-P2, $4.00 in paper copy, $2.25 in microfiche. Report ACADOF-51-VSR, Pt II, (1952). 46 p, 15 fig, 1 tab.

Descriptors: *Georgia, *South Carolina, *Ecology, *Primary productivity, Aquatic productivity, *Water quality, *Coliforms, Stream, Natural stream, On-the-site survey, Food chain, Water temperature, Aquatic microorganisms, Biochemical oxygen demand.
Identifiers: *Savannah River(SC-Geo), Stream survey, Upper Three Run.

The Savannah River in the vicinity of the Savannah River Project as measured by its diversity of species is a healthy natural river. Certain adverse ecological factors limit its productivity, but it has a well balanced biodynamic cycle. The results of the fall survey substantiate for the most part the conclusion of the summer survey. The main deviation is that for some groups it seems more productive than thought at first. Upper Three Run is also a natural stream with a well balanced pattern of life. (See also W76-10041 and W76-10043) (Katz)
W76-10042

BIOLOGICAL SURVEY OF THE SAVANNAH RIVER IN THE VICINITY OF THE SAVANNAH RIVER PROJECT. PART III - REPORT ON THE WORK DONE AND TENTATIVE CONCLUSIONS ON THE WINTER SURVEY,
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
F. L. Carter, T. Dolan, IV, G. McCammon, S. Roback, and J. H. Wallace.
Available from the National Technical Information Service, Springfield, Va 22161 as TID-26669-P3, $4.50 in paper copy, $2.25 in microfiche. Report ACADOF-51-VSR (Pt. III), April, 1952. 60 p, 1 tab, 25 fig.

Descriptors: *Stream, *Surveys, *Freshwater fish, Aquatic plants, Aquatic insects, *Aquatic life, *Coliforms, *Georgia, Ecology, Primary productivity, Biochemical oxygen demand, Natural stream, Water quality, *South Carolina.
Identifiers: *Savannah River(SC-Geo).

The Savannah River was studied during the third survey under winter conditions. The total amount of aquatic life was probably much the same for most groups at this time as during the time of the previous surveys. High water and the resulting ecological conditions caused a decrease in the numbers of organisms collected and the apparent population was less. There had been an apparent

seasonal change in species in most of the groups. However, in the case of the insects and fish this was more apparent than real, for during the previous surveys the organisms had been too small to be readily collected. Among the algae there had been an actual change in the common species. The number of species in the various groups remained quite comparable. According to the method used for measuring the health of a river, all stations continued to be rated as 'healthy'. (See also W76-10041 and W76-10042) (Katz)
W76-10043

SAVANNAH RIVER BIOLOGICAL SURVEY, SOUTH CAROLINA AND GEORGIA, AUGUST, 1954.
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
May, 1955. 63 p, 3 fig, 1 tab, 4 ref.

Descriptors: *South Carolina, *Georgia, *Surveys, *Freshwater fish, *Sediments, Natural stream, *Water quality, *Diatoms, *Aquatic plants, *Aquatic animals, Aquatic insects, Water quality, Protozoa.
Identifiers: Aquatic protozoa, Savannah River(SC-Geo).

A survey of two stations in the Savannah River in the vicinity of the Savannah River Plant of the Atomic Energy Commission was made. The purpose was to determine the effects on aquatic life of the functioning of Clark Hill Dam. This investigation was made at the end of August, 1954. The study indicated a considerable increase of life in the river both as to numbers of species and size of populations. This increase was especially notable as compared with the summer survey made in 1951. Only in the invertebrate fauna was there no conspicuous change in total populations. The operation of the dam has reduced the silt load and stabilized the water flow. Clearer water has deepened the photosynthetic zone. The resultant greatly increased growth of plants is furnishing more food for animals. The more stable water level has enabled many of the shallower-water areas to be occupied continuously by a variety of organisms. The banks of the river, which had been continually eroding, have become more stabilized. No deleterious effects from the operation of the Savannah River Projects were observed. At the stations studied the Savannah River is classified as 'healthy'. (Katz)
W76-10044

EFFECTS OF LARGE SCALE FOREST FIRES ON WATER QUALITY IN INTERIOR ALASKA,
National Environmental Research Center, College, Alaska. Arctic Environmental Research Lab.
F. B. Lotspeich, E. W. Mueller, and P. J. Frey.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-241 922, $5.50 in paper copy, $2.25 in microfiche. Report EPA-660/3-75-020, February, 1970. 116 p, 18 tab, 13 fig.

Descriptors: *Water quality, *Alaska, *Sediments, Aquatic environment, *Degradation(Stream), *Forest fires, *Erosion control, Water chemistry, Sediment discharge, Sediment load, Water quality, Forests, Soils, Aquatic insects, Benthos, On-the-site survey.
Identifiers: Erosion protection, Interior Alaska, Soil saturation, *Taiga(Alas), Lightning fires.

Large and frequent fires are not new to the Taiga of Alaska, nor is Alaska unique among northern regions in this respect. Interior Alaska was very dry in the summer of 1966 and thunderstorms were frequent. The fire, on which this report is based, was caused by lightning on July 23, 1966, and burned into September covering a total of over 1/4 million acres. The objectives of this study were: to develop sufficient understanding of the effects of forest fires on water quality of Alaskan streams so that it may be possible to make rational decisions for allocating manpower and funds for controlling specific fires and to develop an understanding of needs for rehabilitation (revegetation, erosion prevention, etc.) to control immediate and future polluting effects of the fire on the aquatic environment. (Katz)
W76-10045

ECOSYSTEMS ANALYSIS OF THE BIG CYPRESS SWAMP AND ESTUATIES,
Environmental Protection Agency, Athens, Ga. Surveillance and analysis Div.
For primary bibliographic entry see Field 6G.
W76-10046

CHEMICAL HAZARDS RESPONSE INFORMATION SYSTEM, A CONDENSED GUIDE TO CHEMICAL HAZARDS,
Coast Guard, Washington, D. C. Office of Marine Environment and Systems.
For primary bibliographic entry see Field 5A.
W76-10047

CHEMICAL IMPACT OF SNOW DUMPING PRACTICES,
Little (Arthur D.), Inc., Cambridge, Mass.
P. J. O'Brien, P. L. Levins, and C. H. Summers.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-238 764, $4.00 in paper copy, $2.25 in microfiche. Report EPA-670/2-74-086, December 1974, 39 p, 11 tab, 15 fig, 3 ref.

Descriptors: *Calcium chloride, *Chlorides, Surface waters, Runoff, *Snow removal, Snow, *Melt water, Water quality, *Lead, Water supply, Snow management, Roads, Snow melt, Nitrates, Phosphates, Chromium, Iron, New York, Massachusetts.
Identifiers: *Mohawk River(NY), *Concord River(Mass), Highway deicing chemicals.

A study was conducted to evaluate the chemical effects of dumping of snow collected from the municipal streets into watercourses or waterbodies in three selected areas: a large river (Mohawk at Schenectady, N. Y.), a smaller river (Concord at Lowell, Mass), and a small pond (Horn at Woburn, Mass.). Unusually low snowfall during the winters of 1972-73 and 1973-74 together with a nationwide gasoline shortage (which limited or curtailed snow dumping operations) resulted in insufficient data. The following conclusions are, therefore, based on limited observations and tests: 1. Little effect of snow dumping was observed in the downstream concentration of any species examined. 2. Increased chemical concentrations observed during the late summer low-flow period were as great as any effect related to salt use examined in this study. 3. The maximum possible increase in concentration of chloride was calculated to be no more than 0.04 mg/l in the waterbody of lowest dilution volume (Horn Pond). This concentration is less than precision of the assay technique used. (Katz)
W76-10049

AN ANALYSIS OF THE DYNAMICS OF DDT AND ITS DERIVATIVES, DDD AND DDE, IN MARINE SEDIMENTS
Stanford Univ., Pacific Grove, Calif. Hopkins Marine Station.
J. H. Phillips, E. E. Haderlie, and W. L. Lee.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-238 511, $5.50 in paper copy, $2.25 in microfiche. Report EPA-660/3-75-013, May 1974, 97 p., 24 tab., 6 fig., 11 ref.

Descriptors: *DDT, *DDE, *DDD, Pesticides, Laboratory analysis, Bays, Statistical methods, *Pesticide kinetics, *California, Pacific Ocean, Microorganism, *Sediments, Aquatic soils, Bottom sediments, Methodology, Sampling, *Chlorinated hydrocarbon pesticides, Pollutant identification.
Identifiers: *Monterey Bay(Calif).

Concentrations of the three chlorinated hydrocarbons, DDT, DDD, and DDE, were measured in sediments at 57 stations in Monterey Bay on the Central California coast during 1970 and 1971. Mean concentration in parts per billion was DDT 3.1, DDD 2.3, and DDE 5.4. Maximum concentrations were DDT 19.3, DDD 8.7, DDE, 20.5 parts per billion. The distribution of the three compounds within South Monterey Bay was charted. During 1973 nineteen of the original stations, representing locations that had low intermediate, and high concentration in the original survey, were resampled. The mean concentrations approximately three years later were DDT 15.5, DDD 2.3, and DDE 5.4 parts per billion with maximum levels of DDT 83.1, DDD 11.4 and DDE 17.5 parts per billion. A chart of the concentrations in South Monterey Bay revealed essentially the same distribution of chlorinated hydrocarbons. Laboratory assays were developed to determine the relative rate of decomposition in sediment placed under conditions selective for various physiologically different kinds of microorganisms. 14-C ring labelled substrates wer used in all assays. Decay of the three chlorinated hydrocarbons under aerobic conditions without additional nutrients was greater than decay under anaerobic conditions. (Katz)
W76-10050

EFFECTS OF THERMAL AND CHEMICAL DISCHARGES FROM NUCLEAR POWER PLANTS,
Battelle Pacific Northwest Labs., Richland, Wash.
W. L. Templeton, M. J. Schneider, and C. I. Gibson.
Available from NTIS, Springfield, Va 22161 as BNWL SA5206 $5.00 in paper copy, $2.25 in microfiche. Presented at I.A.E.A. Research Coordination Meeting on the Physical and Biological Effects on the Environment of Cooling Systems and Thermal Discharges atC Nuclear Power Stations, Oak Ridge National Laboratory, 18-22 November, 1974, 33 p, 7 tab, 6 fig, 14 ref.

Descriptors: *Bioassay, *Toxicity, *Water temperature, Inland waterways, Thermal power, Nuclear energy, *Columbia River, *Salmonids, Fish physiology, *Fish diseases, Physiological ecology, Animal physiology, Freshwater fish, *Thermal pollution, Pacific northwest, Heat resistance, Water pollution effects, *Chemical wastes.
Identifiers: *Gas Bubble disease, Hanford works(Wash), Biochemical responses, Blood glucose, Blood lactate, Cold shock.

Effects of the thermal discharges of nuclear power plants on the aquatic environment are reviewed, with particular emphasis of the salmonid and other fish species of the Pacific Northwest that are present near the Hanford works Washington. (Katz).
W76-10051

A REVIEW OF THE LITERATURE ON THE USE OF SIMAZINE IN FISHERIES,
Fish and Wildlife Service, LaCrosse, Wis. Fish Pesticide Research Unit.
W. L. Mauck.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-235 455, $4.50 in paper copy, $2.25 in microfiche. Report No. FWS-LR-74-16, March, 1974. 46 p., 2 tab., 78 ref.

Descriptors: *Toxicity, *Marsh management, *Reviews, *Bibliographies, *Biocides, Freshwater fish, Habitat improvement, Wildlife habitat, *Herbicides, Fish establishment, Fish farming, Aquatic fauna, Aquatic plants, Aquiculture, Water pollution effects.
Identifiers: *Simazine, Aquatic herbicides, Literature reviews.

Simazine is a systemic herbicide that has been registered and used for many years for weed control in crops and industrial areas. In recent years, the use of simazine as an aquatic herbicide has been extensively investigated. Simazine was found to be efficaceous, to have relatively low toxicity to aquatic fauna, and to be residual, but it did not accumulate in non-target organisms. Most of the required information for simazine registration as an aquatic herbicide has been acquired. Additional data for registration are needed in the areas of fish and water tolerances. Registration could be completed by late 1974 or early 1975 according to Ciba-Geigy Chemical Corporation. (Katz)
W76-10052

BIODEGRADABILITY AND TOXICITY STUDIES OF PHOTOGRAPHIC PROCESSING WASTES AT OFFUTT AFB, NEBRASKA,
Environmental Health Lab., Kelly AFB, Tex.
J. F. Thomas, and E. E. Lefebvre.
Available from the National Technical Information Service, Springfield, Va 22161, as AD-784 786, $4.00 in paper copy, $2.25 in microfiche. EHL(K) 74-16, July, 1974, 31 p., 9 tab., 4 fig., 9 ref.

Descriptors: *Toxicity, *Bioassays, *Minnows, *Silver, *Biochemical oxygen demand, *Sludge digestion, *Chemical oxygen demand, Laboratory studies, *Biodegradation, Metahodology, Sewage treatment Oxygen, Nebraska, Water pollution effects.
Identifiers: *Fathead minnow, Pimephales promelas, *Photographic processing wastes, Offutt AFB(Neb), Respirometer, Warburg.

Biodegradation and toxicity studies were completed for photographic processing wastewaters generated by the 544th Aerospace Reconnaissance Technical Wing (SAC) Photo Plant at Offutt AFB, Nebraska. Two sets of samples were collected from the generated wastewaters, one in March and the other in September 1972. Composite samples were prepared from each of the sets and evaluated for biodegradability and toxicity. The toxicity studies were performed by using Pimephales promelas (Fathead Minnow) as test animals and the effluent from a bench-scale activated sludge plant treating the composite photowaste samples. The toxicity of the photowaste composite prepared from the March set of samples was approximately 20 times that of the composite prepared from the September set of samples after treatment. The biodegradation and toxicity potentials of photo processing wastewaters will be dependent upon the type of processing, quantity of processing, silver recovery, reprocessing and recycling of the generated wastes prior to entering the biodegradation system. (Katz)
W76-10053

WATER QUALITY DATA FROM TRUCKEE AND CARSON RIVERS. PYRAMID LAKE AND LAHONTAN RESERVOIR, A WORKING PAPER.
Environmental Protection Agency, San Francisco, Calif.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-238 930 $5.00 in paper copy $2.25 in microfiche. October, 1971. 74 p., 27 tab., 13 fig.

Descriptors: *Water quality, *Navada, Surface waters, *Irrigation design, *Waste water disposal, *Phosphates, *Water temperature, *Eutrophication, Lake Basin, Irrigation, Water management(Applied), Land development, Water rights, Irrigation practices, Benthic organisms.
Identifiers: Truckee River(Nev), Carson River(Nev), Pyramid Lake(Nev), Lahontan Reservoir(Nev).

Recommendation are made for operating criteria and procedures that would maximize the use of flows required to meet the water entitlement of the Truckee-Carson Irrigation District (TCID) and to minimize diversion of the Truckee River so that as much water as possible could be provided to Pyramid Lake. Developing such recommendations involved maing economic, population, and waste load projections; predicting the effects of planned development projects and proposed management plans, and determining water needs within the river basins. (Katz)
W76-10054

CONSIDERATIONS ON THE EFFECTS OF HIGH TEMPERATURES ON ALGAE AND FISHES, A LITERATURE REVIEW, 1954,
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
E. L. Verplanck, N. M. Wallace, and J. Cairns, Jr.
Available from the National Technical Information Service, Springfield, Va 22161 as TID 26670 $5.00 in paper copy, $2.25 in microfiche. May, 1954. 82 p., 7 tab., 212 ref.

Descriptors: *Review, *Bibliographies, *Thermal pollution, Water pollution effects, *Nuclear power plants, Temperature, Environmental effects, Laboratory analysis, Freshwater fish, Algae, *Water temperature, Electric power, Diatoms, *Lethal limit, Georgia, South Carolina.
Identifiers: *Savannah River(SC-Geo), Upper-lethal temperature, Acclimation, Literature reviews.

This review of the literature demonstrates that prolonged and uniform heating of a body of water to 33 to 55C would be deleterious to the fish and algae characteristic of southern temperate rivers such as the Savannah. However, if certain areas of the river could be maintained below this temperature the fishes could retreat to such areas provided the oxygen content and other environmental characteristics were suitable. Likewise, if certain chregions in shallow water could be maintained with temperatues of 30C or lower a diversified algal flora would survive in such areas. (Katz)
W76-10055

PRELIMINARY ENVIRONMENTAL SURVEY, NEWPORT ARMY AMMUNITION PLANT, NEWPORT, INDIANA, JANUARY, 1973,
Edgewood Arsenal, Aberdeen Proving Ground, Md. Biomedical Lab.
J. G. Pearson, D. A. Stiles, E. S. Bender, and J. S. Gibson.
Available from the National Technical Information Service, Springfield, Va 22161 as AD-A001 537, $3.50 in paper copy, $2.25 in microfiche. Special Publication, EB-SP-74010, October, 1974. 67 p, 14 fig, 68 ref.

Descriptors: Environment, Aquatic environment, Terrestrial habitats, *Wildlife habitats, Chemical industries, Mammals, Birds, Freshwater fish, Environmental control, Balance of nature, Habitats, Industries, *Indiana, Reptiles, Amphibians, Invertebrates, Wildlife, *Chemical wastes, Surveys.
Identifiers: Newport Army Ammunition Plant(Ind), *Ammunition industry wastes, Vermilion County(Ind), Woodlands, Rare species, Endangered species.

The information compiled was used to design and interpret results from an ecological survey initiated at Newport Army Ammunition Plant, Newport, Indiana in November 1972 to biologically assess the effects of installation operation. This report contains background information on the nature of Newport Army Ammunition Plant and the surrounding county, the natural resources at the installation, and actual or potential environmental impact on these resources from operations at Newport Army Ammunition Plant. (Katz)
W76-10056

ZINC PHOSPHATE GRANULES IN TISSUE SURROUNDING THE MIDGUT OF THE BARNACLE BALANUS BALANOIDES,
Natural Environment Research Council, Anglesey (Wales). Unit of Marine Invertebrate Biology; and University Coll. of North Wales, Menai Bridge. Marine Science Labs.
G. Walker, P. S. Rainbow, P. Foster, and D. L. Holland.
Marine Biology, Vol. 33, No. 2, p. 161-166, 1975. 1 fig., 2 tab., 21 ref.

Descriptors: Inorganic Compounds, *Phosphates, *Crustaceans, Animal physiology, Zinc, *Cytological studies, *X-ray analysis, Metals, *Absorption, *Chemical analysis, Analytical techniques, Magnesium, Calcium, Potassium, Iron, Invertebrates, Methodology, Spectrophotometry, Electron microscopy, Environmental effects, Trace elements, *Pollutant identification.
Identifiers: Balanus balanoides, Bioaccumulation, *Barnacles, *Tissue analysis, *Zinc phosphate.

The chemical composition of inorganic granules found in parenchyma cells surrounding the midgut of adult Balanus balanoides (L.) was determined. X-ray microanalysis indicated the presence of magnesium, phosphorous, potassium, calcium, iron and zinc in the granules. A quantitative analysis of granule-rich pellets isolated from the midguts of adult barnacles showed that the granules were composed mainly of zinc phosphate, the remaining elements being minor constituents only. (Katz)
W76-10057

SOME ASPECTS OF RECOLONIZATION OF CORAL ROCKS IN EILAT (GULF OF AQABA) BY FISH POPULATIONS AFTER POISONING,
Tel-Aviv Univ., (Israel). Dept. of Zoology.
N. Gundermann, and D. Popper.
Marine Biology, Vol. 33, No. 2, p. 109-118, 1975. 1 tab., 6 fig., 13 ref.

Descriptors: *Fishkill, *Poisons, *Toxicants, Coral, Fish populations, Water pollution effects, *Pesticides, Aquatic habitats, *Juvenile fish, *Food webs, *Benthos, Tropical regions, Aquatic environments, Fish behavior, Algae, Endrin, *Chemical wastes, Growth rates, Reefs.
Identifiers: Recolonization, Tropical fish, *Coral fish, Damsel fish, Barracuda, Lion fish, Scaridae, Labridae, Sparidae, Ciandrin, Ariosal, Kavion, *Red Sea.

As a result of an accident, a limited strip of the coast of Eilat (Gulf of Aqaba, Red-Sea) was affected by pesticides and chemicals that killed all fishes. The area was observed monthly for the following year, to study the recovery of fish populations. The study also included observations on growth rate of fish and size populations. Recovery of fish populations was complete 10 to 12 months after the poisoning. It is believed that this is due to the relatively small size of the contaminated area and the survival of most invertebrates that constitute an important part of the biotope of the fish. (Katz)
W76-10058

EFFECT OF TEMPERATURE AND TEMPERATURE ADAPTATION ON CALCIFICATION RATE IN THE HERMATYPIC CORAL POCILLOPORA DAMICORNIS,
Loma Linda Univ., Calif. Dept. of Biology.
C. D. Clausen, and A. A. Roth.
Marine Biology, Vol. 33, No. 2, p. 93-100, 1975. 3 fig., 4 tab., 17 ref.

Descriptors: Environmental effects, Animal physiology, *Radioisotopes, Coral, Reefs, Temperature, *Calcium, Analytical techniques, *Growth rates, *Adaptation, Calcium compounds, Marking techniques, Tracers, Aquatic animals, Benthic fauna, Laboratory tests, Calcium car-

bonate, Invertebrates, Animal growth, *Water temperature, *Thermal pollution, Pollutant identification, Water pollution effects.
Identifiers: *Pocillopora sp., *Calcification rate.

Using 45Ca incorporation into the coral skeleton as a measure of calcification rate, the effect of temperature on calcification rate was studied in the hermatypic coral Pocillopora damicornis. Both immediate and longterm (adaptation) effects were investigated. Temperature has a marked effect on rate - an effect that varies depending on the temperature history of the coral (i.e., temperature adaptation occurs). P. damicornis showed both 27 and 31 C temperature optima, one or the other being dominant depending on the natural water temperature to which the coral was adapted. The two optimum temperatures may indicate two isoenzymes or two alternate metabolic pathways involved in the calcification process. (Katz)
W76-10059

PHOTOSYNTHETIC STUDIES OF CHONDRUS CRISPUS,
New Hampshire Univ., Durham. Dept. of Botany.
A. C. Mathieson, and T. L. Norall.
Marine Biology, vol. 33, No. 3, p. 208-213, 1975. 2 fig., 20 ref.

Descriptors: Plant physiology, *Photosynthesis, Temperature, Genetics, *Seasonal, *Light, Environmental effects, *Respiration, *Spatial distribution, *Intertidal areas. *Adaptation, Energy conversion, Primary productivity, Laboratory tests, Carbon cycle, Plant breeding, Summer, Reproduction, Aquatic plants.
Identifiers: Net photosynthesis, *Chondrus crispus, Irish moss.

The net photosynthesis of intertidal, subtidal, carposporic, tetrasporic, and winter versus summer acclimatized plants of Chondrus crispus were evaluated under different temperatures and quantities of light. The optimum temperature and light conditions for net photosynthesis are seasonally and spatially variable, and there is an adaptive shift in the photosynthetic capacity at different seasons and positions on the shore. Plants collected during the fall and winter had lower light optima (465 to 747 ft-c) for net photosynthesis than spring and summer specimens (about 1000 ft-c). Intertidal populations exhibited a higher rate of net photosynthesis between 250 and 2819 ft-c than subtidal plants. Temperature tolerance was greater in summer plants and shallow subtidal plants, than in winter plants and deep subtidal plants. Tetrasponic plants (diploid) showed a higher rate of net photosynthesis than carposporic plants (haploid) and may extend deeper in the subtidal zone because of this. (Katz)
W76-10060

TUBE-WORM-SEDIMENT RELATIONSHIPS IN POPULATIONS OF PECTINARIA GOULDII (POLYCHAETA: PECTINARIIDAE) FROM BARNEGAT BAY, NEW JERSEY,
Rutgers-The State Univ., New Brunswick, N. J. Dept. of Zoology.
For primary bibliographic entry see Field 2L.
W76-10061

ULTRASTRUCTURAL CHANGES IN THE HEPATOCYTES OF GREEN SUNFISH, LEPOMIS CYANELLUS RAFINESQUE, EXPOSED TO SOLUTIONS OF SODIUM ARSENATE,
Texas Univ. at Austin. Dept. of Zoology.
E. M. B. Sorensen.
Journal of Fish Biology, Vol. 8, No. 3, p. 229-240, 1976. 8 fig., 1 tab., 37 ref.

Descriptors: *Sunfishes, *Bioassay, Laboratory tests, *Arsenic compounds, *Absorption, *Cytological studies, Morphology, *Toxicity, Water pollution effects, Pathology, Fish physiology, Methodology, Analytical techniques, Electron microscopy, *Fish diseases, *Pollutant identification.
Identifiers: Lepomis cyanellus, Bioaccumulation, Hepatocytes, Liver, Sublethal effects, *Sodium arsenate.

The rate and level of arsenic accumulation in the liver of green sunfish is greater than that in the other organs examined. The level to which arsenic is concentrated is positively associated with the concentration of arsenic in solution in the immediate environment of a fish, the duration of exposure to arsenic, and water temperature. Since it was found that accumulation causes histopathological changes, a study was made to examine the appearance of and rate of change in hepatocyte ultrastructure morphology, following exposure to arsenic concentrations of 0, 30, or 60 ppm and after exposure times of one, two, or three weeks at 20 C. As arsenic concentration and exposure time increased, electron dense particles were observed, and the numbers of intranuclear and cytoplasmic electron dense particles and aberrant mitochondria increased. Also, lysosomes and smooth endoplasmic reticulum increased in number, while the number of myelin figures decreased. (Katz)
W76-10062

INFLUENCE OF TEMPERATURE AND SALINITY ON ROUTINE METABOLIC RATE AND GROWTH OF YOUNG ATLANTIC MENHADEN,
National Marine Fisheries Service, Beaufort, N. C. Atlantic Estuarine Fisheries Center.
W. F. Hettler.
Journal of Fish Biology, Vol. 8, No. 1, p. 55-65, 1976. 7 fig., 4 tab., 21 ref.

Descriptors: *Salinity, *Temperature, *Growth rates, Environmental effects, Laboratory tests, *Juvenile fish, *Fish behavior, *Metabolism, Respiration, Analytical techniques, Saline water fish, Estuaries, Juvenile growth stage, Larvae, Aquatic environment, Feeding rates, Water pollution effects.
Identifiers: *Menhaden, Sublethal effects.

Factors affecting the metabolic rate of schooling juvenile menhaden were examined. Temperature had little effect on routine metabolic rates of juveniles. Variations in salinity affected metabolic rate with a possible indication that metabolic rate is lowest at intermediate salinities. The metabolic cost of maintaining water balance and ion exchange may account for the increased oxygen consumption at high and low salinities. Feeding caused a twofold increase in metabolic rate due in part to rapid swimming during the feeding period. Starvation resulted in a decreased metabolic rate. Larvae raised at high salinity (28-34 ppt) were found to grow at a significantly slower rate than menhaden larvae raised at low salinity (5-10 ppt). Results may be due to differences in activity and additional replications are necessary. (Katz)
W76-10063

A COMPARISON OF GROWTH AND ABUNDANCE FOR TIDAL POOL FISHES IN CALIFORNIA AND BRITISH COLUMBIA,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 2L.
W76-10064

EFFECTS OF HYPERBARIC PRESSURE ON OXYGEN CONCENTRATION IN THE SWIM BLADDER OF POECILIA LATIPINNA,
Miami Univ., Fla. Dept. of Anesthesiology.
S. Ross.
Journal of Fish Biology, Vol. 8, No. 1, p. 1-4, 1976. 1 fig., 16 ref.

Descriptors: *Pressure, Depth, *Laboratory tests, *Fish physiology, *Oxygen, *Hydrostatic pressure, Environmental effects, *Hydrogen ion concentration, Teleosts, Gases, Methodology, Analytical techniques, Aquatic environment, Water pollution effects.
Identifiers: *Poecilia latipinna, Swim bladder, Gas gland, Blood chemistry.

Poecilia latipinna was subjected to varying hydrostatic pressures in the laboratory. The hyperbaric chamber is suitable apparatus for testing gas gland secretion in this teleostean fish. Oxygen concentration within a swim bladder increased with increasing hydrostatic pressure. Pressures encountered by fishes at various levels of the water column and their effects on oxygen concentration in the swim bladder may be simulated in the laboratory. (Katz)
W76-10066

IRRADIANCE REDUCTION: EFFECTS ON STANDING CROPS OF THE EELGRASS, ZOSTERA MARINA IN A COASTAL LAGOON,
San Diego State Univ., Calif. Dept. of Botany.
T. W. Backman, and D. C. Barilotti.
Marine Biology, Vol. 34, No. 1, p 33-40, 1976. 6 fig., 3 tab., 26 ref.

Descriptors: *Environmental effects, *Plant growth, *Growth rates, *Light intensity, *Productivity, *Light penetration, *Lagoons, *Marine plants, *On-Site investigations, Shallow water, Standing crops, Primary productivity, Population, Methodology, Biomass, Seasonal.
Identifiers: *Zostera sp., *Eelgrass, *Shade, *Irradiance.

Abundance of the eelgrass Zostera marina was studied in a coastal lagoon in southern California and was found to correlate with the level of irradiance at depths greater than 0.5 m below tidal datum. Results of controlled field experiments, using canopies to reduce downwelling illuminance by 63%, confirmed that turion density is a function of the irradiance the plants receive. By Day 18 of the experiment, turion density in the shaded experimental areas had decreased compared to the density of unshaded controls. Flowering in the experimental areas was also inhibited by shading. The biological implications are discussed in terms of seasonal changes and man's intervention in the natural process of coastal lagoons. (Katz)
W76-10067

PETROLEUM HYDROCARBONS: DEGRADATION AND GROWTH POTENTIAL FOR ATLANTIC OCEAN SEDIMENT BACTERIA,
Maryland Univ., College Park. Dept. of Microbiology.
J. D. Walker, J. J. Calomiris, T. L. Herbert, and R. R. Colwell.
Marine Biology, Vol. 34, No. 1, p 1-9, 1976. 4 fig., 6 tab., 20 ref.

Descriptors: *Biodegradation, *Growth rates, Aquatic bacteria, Organic compounds, *Sediments, *Bacteria, *Degradation(Decomposition), *Pseudomonas, Nutrient requirements, Sampling, Laboratory test, Analytical techniques, Microorganisms, Environmental effects, Marine bacteria, Methodology, *Oil pollution, Water pollution effects, Atlantic Ocean.
Identifiers: *Petroleum Hydrocarbons.

Water, sediment, and microorganisms were sampled at stations along a trackline in the Atlantic Ocean off the North Carolina Coast at depth of 9 to 5,000 m. Selected chemical and physical parameters were measured. At three of the stations, microorganisms isolated from sediment were examined for ability to degrade a number of petroleum hydrocarbons. Media made up with seawater or salts solution supplemented nitrate and phosphate were employed in the degradation study; significant growth and hydrocarbon degradation was observed. Bacteria from sediment

samples collected at a depth of 5,000 m showed greater growth and and hydrocarbon degradation when cultured in a sea-water medium than in media made up with salts solution. Growth of bacteria in sediment samples collected at two stations was found to be suppressed in seawater medium when a 1% (v/v) mixture of 19 different petroleum hydrocarbons was added. The hydrocarbon mixture was useful in determining the hydrocarbons degrading potential of microorganisms isolated from the ocean environment. (Katz)
W76-10068

PHYSICAL FACTORS CONTROLLING ABUNDANCE OF MEIOFAUNA ON TIDAL AND ATIDAL BEACHES,
Jordan Univ., Amman. Marine Science Programme.
For primary bibliographic entry see Field 5A.
W76-10069

ASPECTS OF PHYSIOLOGICAL CONDITION IN MYTILUS EDULIS L., WITH SPECIAL REFERENCE TO THE EFFECTS OF OXYGEN TENSION AND SALINITY,
Institute for Marine Environmental Research, Plymouth (England).
B. L. Bayne.
In: Proceedings, 9th European Marine Biology Symposium, H. Barnes, ed, Aberdeen University Press, p. 213-238, 1975. 2 tab., 12 fig., 60 ref.

Descriptors: * Salinity, *Dissolved oxygen, *Amino acids, Stress, Animal physiology, Environmental effects, Adaptation, *Mussels, *Temperature, *Feeding rates, Compensation, *Reviews, Invertebrtes, Laboratory tests, Nitrogen, Crustaceans, Marine animals.
Identifiers: Mytilus edulis, Sublethal effects.

A definition of stress, as applied to marine bivalves, is offered. Experiments on the physiological responses of Mytilus edulis to reduced oxygen tension and reduced salinity are described. Mechanisms of compensation for reduced oxygen tension include a reduction in the ventilation relative perfusion ratio and an increase in the extraction efficiency for oxygen; these processes result in complete acclimation of the rate of oxygen consumption at an oxygen tension of 80 mm Hg, and partial acclimation at 40 mm Hg. Compensation for reduced salinity involves increased rates of excretion of ammonia, loss of certain amino acids, and a decline in the concentration of free amino acids in the mantle tissue consistent with previous studies of volume regulation. The physiological condition of the animal may be assessed in terms of simple, integrated physiological measurements, such as the 'scope for growth' and the 'O:N ratio.' Linked to measurements of the degree of 'disadvantage' the results of a stress condition, they may be used to further understand the ecology of the species. (Katz)
W76-10070

THE IMPORTANCE OF DISSOLVED ORGANIC COMPOUNDS IN SEA WATER FOR THE NUTRITION OF ANEMONIA SULCATA PENNANT (COELENTERATA),
Cologne Univ. (West Germany). Zoological Institut.
D. Schlichter.
In: Proceedings 9th European Marine Biology Symposium, H. Barnes, ed. Aberdeen University Press, p. 395-406, 1975. 10 fig., 21 ref.

Descriptors: *Nutrients, *Cytological studies, Nutrient removal, *Nutrition, Tracers, Animal physiology, Temperature, *Animal metabolism, *Absorption, *Organic compounds, *Amino acids, *Carbohydrates energy, Biological membranes, Mode of action, Analytical techniques, Methodology, Laboratory tests, Pollutant identification, Water pollution effects.
Identifiers: *Anemonia sp., Bioaccumulation, *Dissolved organic compounds.

Anemonia sulcata absorbs and accumulates tritiated L-amino acids and D-glucose dissolved in artificial sea water in their natural concentrations. Absorption occurs through the apical membrane of the ectoderm due to cytological structures. The cells can concentrate the free organic compounds by a factor of 106 the concentration found in the medium. Absorption is affected by temperature and inhibitors and uptake is dependent on energy available. Naturally occurring changes in abiotic environmental factors do not adversely influence the capacity to take up organic compounds. Glucose does not influence the uptake of amino acids while the amino acids can interfere with each other. This suggests absorption by different 'carrier systems.' Calculations show that actinians satisfy a substantial portion of their metabolic requirement by absorbing dissolved organic material from the environment. (Katz)
W76-10071

ON THE RELATIONSHIP BETWEEN OXYGEN CONSUMPTION AND FEEDING LEVEL IN DECAPODS,
London Univ. (England). Dept. of Zoology and Comparative Physiology.
J. C. Aldrich.
In: Proceedings 9th European Marine Biology Symposium, H. Barnes, ed. Aberdeen University Press, p. 407-418, 1975. 3 fig., 25 ref.

Descriptors: *Respiration, *Oxygen requirements, *Animal physiology, *Metabolism, *Feeding rates, Size, Laboratory tests, *Crustaceans, *Crabs, Animal behavior, Temperature, Invertebrates, Energy conversion, Biorhythms, Diurnal.
Identifiers: *Hepatopancreas, Libinia sp., Carcinus sp., Cancer sp., Decapods.

Feeding level has been shown to affect the rate of oxygen consumption in some decapods, namely, an oxyrhynchous crab, Libinia emarginata, and two brachyrhynchous crabs, Cancer pagurus and Carcinus maenus. The size of the hepatopancreas suggests the relative rate of energy flow, a relationship apparently paralleled by the rate of food consumption. On a population basis, the average maximum rate of oxygen consumption appears to indicate the average level of feeding. On an individual basis, the analysis is complicated by great variability with a 3-5 times range of oxygen consumption rate in non-motile crabs kept at constant temperature, both fed and starved. An attempt has been made to distinguish between effects attributable to single meals and excitement and those due to hepatopancreas size and nutritive levels. The possibility of correlating individual oxygen consumption rates and nutritive levels is discussed. (Katz)
W76-10072

AUTUMN MIGRATION AND VERTICAL DISTRIBUTION OF THE BROWN SHRIMP CRANGON CRANGON L. IN RELATION TO ENVIRONMENTAL CONDITIONS,
Rijsinstituut voor Visserijonderzoek, Ymuiden (Netherlands).
R. Boddeke.
In: Proceedings 9th European Marine Biology Symposium, H. Barnes, ed. Aberdeen University Press, p. 483-494, 1975. 10 fig, 12 ref.

Descriptors: *Shrimp, *Reproduction, Seasonal, *Temperature, On-site investigation, Environmental effects, *Autumn, Migration, *Migration patterns, Sexual maturity, *Mature growth stage, *Immature growth stage, *Salinity, Tidal waters, Shellfish, Animal behavior, *Spatial distribution, Temporal distribution, Life cycles, Movement, Population.
Identifiers: Crangon crangon, *Brown shrimp.

The causes of the autumnal migration of the brown shrimp are induced by fluctuations of the water temperature, especially those in the tidal zone, caused by seasonal differences between air and water temperatures. Sexually mature shrimps are more sensitive to temperature fluctuations than sexually less mature shrimp. The autumn migration parallels a period of increasing sexual activity and appears to be a regular process in which waves of shrimps in decreasing stages of sexual ripeness migrate to the open sea one after another. By this rigid patterned process of migration the density of the inshore population is reduced in a regular way, leaving the sexually least mature animals in the areas with the richest food supplies and returning the sexually more mature animals to more or less the same area where they hatched. (Katz)
W76-10073

DIFFERENCES IN LOW PH TOLERANCE AMONG STRAINS OF BROOK TROUT (SALVELINUS FONTINALIS),
Pennsylvania State Univ., University Park. Dept. of Biology.
G. D. Robinson, W. A. Dunson, J. E. Wright, and G. E. Mamolito.
Journal of Fish Biology, Vol. 8, No. 1, p. 5-17, 1976. 2 tab., 5 fig., 24 ref.

Descriptors: *Hydrogen ion concentration, *Acidic water, *Bioassay, *Brook trout, *Temperature, Size, *Fish genetics, Resistance, *Mortality, Acidity, Water quality, Environmental effects, Laboratory tests, Fish physiology, Salmonids, Genetics, Breeding, Water pollution effects, Seasonal.
Identifiers: Salvelinus fontinalis.

Survival time of brook trout (Salvelinus fontinalis) at low pH was directly related to size, and inversely related to temperature. Between pH 2.50 and 3.25 each increase in pH by increments of 0.25 led to a 2-3 fold increase in survival time. At higher pH's (3.25-3.75) elevations in pH by the same increments produced a 3-5 fold increase. Members of seven inbred lines of brook trout were tested for acid tolerance; the lines differed markedly providing strong evidence that acid tolerance is hereditary. Differences in survival of inbred lines were the most marked at pH 3.25. Exposure for 1 week at pH 3.75 resulted in a 20-25% decrease in survival time of 18 fish tested at pH 2.50 and 3.00. Out of a total of 24 trout tested at pH 3.75, two highly tolerant individuals were still alive after 6.1 weeks. Thus it is likely that a strain resistant to a pH below 4.1, the previously recorded lower limit, can be developed by selective breeding. (Katz)
W76-10074

TOXICITY OF POLYCHLORINATED BIPHENYLS (AROCLOR 1254) TO ADULT, JUVENILE AND LARVAL STAGES OF THE SHRIMP PALAEMONETES PUGIO,
Texas A and M Univ., College Station. Dept. of Biology.
G. Roesijadi, S. R. Petrocelli, J. W. Anderson, C. S. Giam, and G. E. Neff.
Bulletin of Environmental Contamination and Toxicology, Vol. 15, No. 3, p. 297-304, 1976. 1 fig., 3 tab., 16 ref.

Descriptors: *Polychlorinated biphenyls, *Aroclor, *Lethal limit, *Bioassay, *Shrimp, Water pollution effects, *Mortality, Estuarine environment, *Larval growth stage, *Immature growth stage, *Toxicity, Chlorinated hydrocarbon pesticides, Laboratory tests, Pesticides, Estuarines, Invertebrates, Aquatic animals, Analytical techniques, *Pollutant identification.
Identifiers: *Palaemonetes sp., Sublethal effects.

Juvenile grass shrimp (Palaemonetes pugio) exposed in a laboratory test to Aroclor 1254 had 96 h LC-50 values from 6.1 to 7.8 micrograms/liter. Adult shrimp had 96 h LC-50 values from 41 to 86 micrograms/liter, showing less sensitivity to the PCB than was observed in juvenile shrimp. The effect of Aroclor 1254 on grass shrimp larvae was evident both as mortalities at 15.6 micrograms/liter

and increased duration to the post larval stage at lower exposure levels. (Katz)
W76-10075

SOME EFFECTS OF ACIDIFIED WATER ON THE EARLY DEVELOPMENT OF ROACH (RUTILUS RUTILUS L.) AND PERCH (PERCA FLUVIATILIS L.),
Uppsala Univ. (Sweden). Inst. of Zoophysiology.
N. Johansson, and G. Milbrink.
Water Resources Bulletin, Vol 12, No 1, p 39-48, February, 1976. 2 fig, 6 tab, 7 ref.

Descriptors: *Hydrogen ion concentration, Laboratory tests, On-site investigations, Adaptation, Environmental effects, Reproduction, *Fish eggs, *Immature growth stage, Fish reproduction, Hatching, *Perches, *Acidic water, Mortality.
Identifiers: Perca sp, Rutilus sp, *Roach.

Fertilized eggs of perch (Perca fluviatilus) and roach (Rutilus rutilus) were reared at different pH values in the field and in the laboratory. The results from the laboratory tests revealed that both species showed at least a 50% decrease in hatching frequencies when reared at pH values below 5.6. At pH values below 4.6 both species studied show an almost complete lack of reproduction. The field studies with eggs from different lakes indicated that there might be an adaptation, manifesting itself as a higher frequency of hatching in water with a composition similar to that of the natural habitat. Field experiments also showed that the roach is more sensitive than perch to low pH values. (Katz)
W76-10076

EFFECTS OF KRAFT MILL EFFLUENTS ON BENTHIC MACROPHYTE ASSEMBLAGES IN A SHALLOW-BAY SYSTEM (APALACHEE BAY, NORTH FLORIDA, U.S.A.),
Florida State Univ., Tallahassee. Dept. of Biological Science.
M. S. Zimmerman, and R. J. Livingston.
Marine Biology, Vol 34, p 297-312, 1976. 8 fig, 4 tab.

Descriptors: *Distribution patterns, Plant groupings, Bays, *Biomass, Water pollution sources, Water pollution effects, Benthic fauna, Benthic flora, Biological communities, *Pulp wastes, Shallow water, *Dominant organisms, *Benthos, Biota, Population, Turbidity, Water quality, Aquatic plants, Sampling, Methodology, Statistical models.
Identifiers: Species diversity, *Apalachee Bay(Florida), Kraft mill effluents, Macrophytes.

A 14-month study was carried out to determine the impact of kraft-mill effluents on the offshore benthic macrophyte distribution in a shallow north Florida bay. A polluted river drainage system was compared to an adjoining unpolluted one. Affected areas were characterized by elevated levels of color and turbidity, reduced benthic macrophyte biomass, reduced species diversity and altered species composition. Areas of chronic impact had reduced biomass. On either side of the drainage system uniform increases in number of species were observed. Benthic macrophyte distribution, in terms of biomass and species composition, was considered an important indicator of the impact of KME on this shallow-bay system. Species normally inhabiting deeper water were found in areas of increased turbidity and color, thus explaining the maintenance of species diversity with reduced biomass. Benthic plant assemblages reflected variations in dominance and the occurrence of opportunistic species. (Katz)
W76-10077

EFFECTS OF CALCIUM, STRONTIUM, AND MAGNESIUM ON THE COCCOLITHOPHORID CRICOSPHAERA (HYMENOMONAS) CARTERAE. I. CALCIFICATION,
South Carolina Univ., Columbia. Electron Microscope Lab.
R. L. Blackwelder, R. E. Weiss, and K. M. Wilbur.
Marine Biology, Vol. 34, No. 1, p 17-22, 1976. 3 fig, 2 tab, 17 ref.

Descriptors: *Calcite, *Algae, Environmental effects, *Calcium, *Magnesium, *Strontium, Plant morphology, Mineralogy, Nutrient requirements, Analytical techniques, Laboratory tests, *X-ray diffraction, Pollutant identification.
Identifiers: *Coccolithophorids, *Calcification, *Cricosphaera sp, Coccoliths, Aragonite.

The capacity of cells to calcify in various concentrations of calcium, strontium and magnesium ions was examined following preliminary decalcification in CO2. At a concentration of .01 M Ca, 75% of the cells formed coccoliths within 24 h and almost all cells were recalcified after 2 days. At .001 and .0001 M Ca no recalcification occurred. With the addition of Sr to the Ca-deficient media, calcification took place and the percentage of calcified cells increased with increasing concentrations of Sr. Strontium added to Ca-deficient media was much more effective than an equivalent concentration of Ca. No Sr was deposited in the coccoliths. X-ray analysis demonstrated that calcite was deposited by cells in all concentrations of Ca and Sr at which calcification took place. At concentrations of Mg in the media of 0.0 to .042 M, the cells retained their ability to calcify, although calcification was reduced in the absence of Mg and only calcite was formed. (See also W76-10079) (Katz)
W76-10078

EFFECTS OF CALCIUM, STRONTIUM AND MAGNESIUM ON THE COCCOLITHOPHORID CRICOSPHAERA (HYMENOMONAS) CARTERAE. II. CELL DIVISION,
Duke Univ., Durham, N.C. Dept. of Zoology.
R. E. Weiss, P. L. Blackwelder, and K. M. Wilbur.
Marine Biology, Vol. 34, No. 1, p 17-22, 1976. 6 fig, 12 ref, 1 tab.

Descriptors: *Algae, Plant morphology, *Growth rates, *Calcium, *Strontium, *Magnesium, *Cytological studies, Plant morphology, Marine algae, Mineralogy, Nutrient requirements, Environmental effects, Marine biology, Nutrients.
Identifiers: *Coccolithophorids, *Cricosphaera carterae, *Cell division, Cell organelles.

Calcium at low levels of .001 M caused reduced growth in the alga Cricosphaera (Hymenomonas) carterae and growth was absent at .0005 M Ca. The addition of Sr to Ca-deficient media enabled cells to divide, the effect increasing with Sr concentration. When 4.6 x 1/10,000 M Sr was added to media containing 1/10,000 M Ca, the rate of division and the final cell concentration were comparable to the control (1/100 M Ca). Strontium was 20 times more effective than Ca. Cell division was nearly absent in Mg concentrations below 4.2 x 1/100,000 M. Cell size increased as the Mg concentration decreased. The lowest protein concentration was found in the absence of Mg. In media lacking Mg, cells exhibited changes in ultrastructure. Fragmentation of chloroplasts and mitochondria was also observed. (See also W76-10078) (Katz)
W76-10079

INFLUENCE OF TEMPERATURE ON BEHAVIOUR, ENERGY METABOLISM AND GROWTH OF MACOMA BALTHICA (L.),
Nederlands Instituut voor Onderzoek der Zee, Texel.
P. A. W. J. de Wilde.
In: Proceedings, 9th European Marine Biology Symposium, H. Barnes, ed. Aberdeen University Press, p 239-256, 1975. 2 tab, 8 fig.

Descriptors: *Temperature, *Growth rates, *Biomass, *Metabolism, Seasonal, Food abundance, *Benthic fauna, *Invertebrates, Animal behavior, Diurnal, Laboratory tests, *Mortality, Energy, *Feeding rates, Food chains, Food webs, Biorhythms, Methodology, Reproduction, Tidal waters, Nutrition.
Identifiers: *Macoma balthica.

Long-term laboratory experiments were conducted to determine the relationships between temperature, food availability, and internal rhythms on seasonal growth irregularities of benthic macro-invertebrates. Macoma balthica thrived best at temperatures from 0-15 C with expulsion of gametes in spring triggered by water temperatures of 10 C. Diurnal behavior patterns were observed which effected energy uptake and expenditure. At higher temperatures deposit-feeding slows down as does food intake. At 15 C the energy balance between food uptake and energy expenditure becomes negative, resulting in emaciation and mortality. Irregular growth in Macoma in its natural habitats is determined by temperature and the availability of living food. (Katz)
W76-10080

BODILY DISTRIBUTION, ACCUMULATION AND EXCRETION OF MERCURY IN A FRESHWATER MUSSEL,
Siena Univ. (Italy). Inst. of Comparative Anatomy.
S. Renzoni, and E. Bacci.
Bulletin of Environmental Contamination and Toxicology, Vol. 15, No. 3, p. 366-373, 1976. 2 fig., 1 tab., 14 ref.

Descriptors: *Mercury, *Bioindicators, *Mussels, Benthic fauna, *Absorption, Water pollution sources, Analytical techniques, Benthos, Shellfish, Invertebrates, Metals, Laboratory tests, *Pollutant identification.
Identifiers: Bioaccumulation, Tissue analysis, Excretion, *Paglia River(Italy).

Mussels collected from the Paglia River, which receives runoff from a mercury extraction operation, were analyzed for mercury content. The whole soft tissue of small mussels (3 cm) contained mercury in concentrations from 0.192 ppm to 0.385 ppm. The digestive gland, gonad and gill of larger mussels contained high concentrations of mercury while the mantle, foot, and adductor muscle contained little. Mercury accumulated in the adductor muscle to greater degrees as the age of the mussel increased. Excretion experiments showed the biological half-life ranged from 15 to 35 days in the gill, gonad, and digestive gland and 60 days for the other tissues. (Katz)
W76-10081

DISTRIBUTION OF SELECTED METALS IN TISSUE SAMPLES OF CARP, CYPRINUS CARPIO,
Marist College, Marist Coll., Poughkeepsie, N. Y. Environmental Science Program
R. Rehwoldt, D. Karimian-Teherani, and H. Altmann.
Bulletin of Environmental Contamination and Toxicology, Vol. 15, No. 3, p. 374-377, 1976. 1 fig., 2 tab., 8 ref.

Descriptors: *Metals, Absorption, Analytical techniques, Cobalt, Chromium, Iron, Zinc, *Carp, Methodology, Fish, Path of pollutants, Fish physiology, *Pollutant identification, Distribution patterns.
Identifiers: Scandium, Lanthium, *Tissue analysis, Bioaccumulation, *Danube River.

Samples of gill, liver, kidney, bone and flesh from carp taken from the Danube River were analyzed for distribution of cobalt, chromium, iron, zinc, lanthium and scandium. Homogenated samples were also analyzed to give total body burden. The

distribution of Co, Cr, Fe and Zn follow the distribution for these metals in mammals, concentrating in the liver and kidneys. Co accumulates somewhat in bone tissue. Lanthium and scandium concentrate in bone tissue. Data seem to indicate that though the distribution in the fish is not uniform, the metals concentrate in edible portions. (Katz)
W76-10082

WATER, ITS EFFECTS ON LIFE QUALITY.
Water Quality Research Council, Lombard, Ill.
For primary bibliographic entry see Field 5F.
W76-10087

POLLUTION EFFECTS ON SURFACE WATERS AND GROUND WATERS, (LITERATURE REVIEW),
Ontario Ministry of the Environment (Toronto).
R. D. Terry, and G. M. Hughes.
Journal of Water Pollution Control Federation, Vol. 48, No. 6, p 1420-1433, June, 1976. 141 ref.

Descriptors: *Water pollution effects, Thermal pollution, Aquatic microbiology, Biochemical oxygen demand, Pollutant identification, Toxins, Wastes, Chlorides, Heavy metals, Zinc, Copper, Cadmium, Phenols, Nutrients, Pesticides, Herbicides, DDT, Nitrogen Nitrate, Phosphorus, Turbidity, Strip mine wastes, Waste treatment, Mathematical models, Leaching, Landfills, *Surface waters, *Groundwater, *Reviews, *Bibliographies.
Identifiers: Sediment contaminants, Basin studies, Water quality models, Lechates, Oil-field brines, Industrial effluents.

Surface and ground water quality study were compiled by the Ministry of the Environment of Canada. The water quality perameters included in these studies were, (1) trace metals in stream and lake sediments, (2) herbicides and pesticides, including DDT, PCB's, phenoxy-acid herbicides, copper sulfate solutions, Fenthion and Dicamba, (3) nutrients including dissolved oxygen, nitrates and phosphates, (4) land-use effects, including biochemical oxygen demand (BOD), heavy metals, asbestos, petroleum products, rubber, nitrogen and phosphorus, (5) industrial effects, including contamination by chloride, pickling liquors, phenolic effluent, thermal effluents and cannery wastes, (6) basin studies and river pollution, (7) water quality models and indices, and (8) contamination of ground water. (Heiss-NWWA)
W76-10104

FLUORIDE TOLERANCE OF JAPANESE QUAIL,
California Univ., Davis. Dept. of Avian Science.
P. Vohra.
Poult Sci. 52(1), p 391-393, 1973.

Descriptors: *Fluorine, *Game birds, *Potable water, Environmental effects, Mortality, Resistance, *Lethal limit, Toxicity, Salt tolerance, Water pollution effects, Public health.
Identifiers: *Japanese quail, Toxicology.

A level of 50 ppm F- in the form of NaF in the drinking water of Japanese quail had no effect on body weight, mortality, tibia weight/100 gm body weight, bone ash or egg shell thickness as compared to distilled water. Levels of F- up to 200 ppm were well-tolerated in drinking water, but a level of 500 ppm was lethal.--Copyright 1973, Biological Abstracts, Inc.
W76-10120

ASYMMETRY ANALYSIS IN FISHES: A POSSIBLE STATISTICAL INDICATOR OF ENVIRONMENTAL STRESS,
Dames and Moore, San Francisco, Calif.
D. W. Valentine, M. E. Soule, and P. Samollow.
U S Nat Mar Fish Serv Fish Bull. 71(2), p 357-370, 1973.

Descriptors: *Statistical methods, *Analytical techniques, Environmental effects, *Fish toxins, *Fish behavior, Aquatic environment, Water pollution effects, *Pollutant identification, Bioindicators, California, Mexico.
Identifiers: Amphistichus-argenteus, *Asymmetry analysis, Leuresthes-tenuis, Paralabrax-nebulifer.

One of the more difficult tasks in evaluating the possible deleterious effects of multiple toxicants on natural communities is in defining subtle effects before the onset of chronic morbidity. Before detectable changes in either species diversity or species abundance occur subtle changes must take place in a number of important processes ranging from molecular to behavioral changes. Unfortunately, changes in these parameters have proven most difficult to detect with current methodology. The possible use of fluctuating asymmetry as a possible measure of environmental stress was examined. Fluctuating asymmetry is simply the random deviation from perfect symmetry of any bilateral anatomical character. It is, therefore, a nonspecific measure of developmental perturbation. Using asymmetry analysis on 3 species of marine teleost-barred sand bass, Paralabrax nebulifer; grunion, Leuresthes tenuis; and barred surfperch, Amphistichus argenteus-from southern California and Baja California (Mexico), 2 possible asymmetry trends, historical and geographic are defined. Asymmetry values are shown to increase as we approach highly populated areas (southern California) both from the north and south and also with time within southern California. Such increased in asymmetry correlate well with the known distribution of various toxicants from this same area.--Copyright 1973, Biological Abstracts, Inc.
W76-10121

A MATHEMATICAL MODEL OF BLOOMS OF PLANKTON DIATOMS, (IN GERMAN),
Deutsche Akademie der Wissenschaften zu Berlin (East Germany). Forschungsstelle fuer Umweltgestaltung.
H. P. Kozerski.
Int Rev Gesamten Hydrobiol. 59(3), p 367-394, 1974.

Descriptors: Eutrophication, Mathematical models, Diatoms, Potable water, Europe, Plankton, Reservoirs.
Identifiers: Asterionella-formosa, *Germany.

Blooms of plankton diatoms are important to the management of drinking water reservoirs in southern East Germany. A mathematical model was developed to find optimal management alternatives. The model consists of coupled differential equations. The 1st step is a very simple model which is compared with a mass development of Asterionella formosa in the Saidenbach reservoir in the Erzgebirge. The dynamic properties of the improved model are examined with respect to various ecological parameters and initial values. Loss rate and initial biomass of phytoplankton exert the greatest influence in bloom dynamics. The results of the model are compared with a bloom of Asterionella in laboratory cultures and with recent data obtained from the reservoir. A qualitative comparison between model behavior and observations in the lake gives information about the validity range of the model parameters and provides ideas for further development. The applicability to water quality management of the model is considered.--Copyright 1975, Biological Abstracts, Inc.
W76-10127

WATER QUALITY IMPLICATIONS OF CATTLE GRAZING ON A SEMIARID WATERSHED IN SOUTHEASTERN UTAH,
Oregon State Univ., Corvallis. Rangeland Resources Program.
For primary bibliographic entry see Field 5G.
W76-10171

MODELS FOR EVALUATION OF HAZARDOUS WASTES,
Municipal Environmental Research Lab., Cincinnati, Ohio.
For primary bibliographic entry see Field 5B.
W76-10190

MINERAL CYCLING IN SOUTHEASTERN ECOSYSTEMS.
Savannah River Ecology Lab., Aiken, S.C.
Available from N.T.I.S., Springfield, Va 22161 as CONF-740513, $24.75 foreign, $27.25. Proceedings of a symposium held at Augusta, Georgia May 1-3, 1974. Published by U.S. Energy Research and Development Administration, Technical Information Center, Office of Public Affairs, 1975. 898 p, CONF-740513. Edited by Fred G. Howell, John B. Gentry, and Michael H. Smith.

Descriptors: *Ecosystems, *Cycling nutrients, *Nutrients, *Southeast US, Aquatic productivity, Food chains, Estuarine environment, *Environmental effects, *Ecology, Recycling, Model studies, Path of pollutants, Biota, Marine fish, Ecological distribution, Water pollution effects, Balance of nature.
Identifiers: *Mineral cycling, Marine environment.

Papers presented during the meeting covered mineral cycling in terrestrial, freshwater, and marine environments, as well as current ideas on modeling. A plenary session examined present knowledge of the principles governing elemental flow, and contributed-paper sessions described recent advances in mineral-cycling research. A panel discussion was devoted to radiocesium in natural environments, especially those in the southeastern United States. (See W76-10267 thru W76-10331)
W76-10266

NUTRIENT RECYCLING AND THE STABILITY OF ECOSYSTEMS,
Georgia Univ., Athens. Dept. of Zoology.
J. R. Webster, J. B. Waide, and B. C. Patten.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, p 1-27. 3 fig, 4 tab, 80 ref, (CONF-740513).

Descriptors: *Stability, *Ecosystems, *Balance of nature, *Cycling nutrients, Resistance, Adaptation, Energy budget, Mathematical models.

This perspective attempts to account for alternatives for persistence at the ecosystem level and at the same time to relate ecosystem response to specific observable and measurable ecosystem attributes. The asymptotic stability of ecosystems is illustrated by equations showing that ecosystem stability is guaranteed by limitations on resource mobilization and by their dissipative character. Resistance, the ability of an ecosystem to resist perturbation, results from the accumulated structure of the ecosystem. Resilience, the ability of an ecosystem to return to a normal trajectory once displaced, reflects inherent dissipative forces. These concepts are shown to be implicit within the linear donor-based model formulations, from which four relative stability indexes were derived: Critical root measures of the system's margin of stability. Mean root is an index of system response time. Natural frequency measures resistance to displacement, and damping ratio measures resilience following displacement. Stochastic analyses indicated that an increase in the amount of recycling relative to input resulted in a decreased margin of stability, faster mean response time, greater resistance, and less resilience. Results also revealed that increased storage and turnover times paralled the relationships as those of recycling. Increase in both recycling and turnover rates produced opposite results, however, leading to a larger stability margin, faster response time, smaller resistance, and greater resilience. (See also W76-10266) (Auen-Wisconsin)

W76-10267

A THEORETICAL BASIS FOR ECOSYSTEM ANALYSIS WITH PARTICULAR REFERENCE TO ELEMENT CYCLING,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
R. V. O'Neill, W. F. Harris, B. S. Ausmus, and D. E. Teichle.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, p 28-40. 3 tab, 43 ref, (CONF-740513).

Descriptors: *Ecosystems, *Theoretical analysis, *Equilibrium, Balance of nature, Biomass, Energy budget, Energy conversion, Energy transfer, Nitrogen, Carbon, *Cycling nutrients.
Identifiers: Terrestrial ecosystems, Aquatic ecosystems.

A conceptualization of ecosystem functions considers: (1) The significance of ecosystem processes, such as element cycling, to the persistence of systems in a fluctuating environment; (2) the control mechanisms regulating these processes; and (3) the construction of a theoretical framework to synthesize available information. The theory assumes that the central strategy of ecosystems is to maintain maximum persistent organic matter, identified by a minimal set of state variables (an autotrophic base, a complex heterotrophic regulators, and a detrital pool) which are the key to the ecosystem's interactions between the components. Although other chemical species are conserved and cycled, nitrogen is of particular interest since it exists naturally in gaseous form and ordinarily must be bound in organic form to be utilized. In addition, since there are no large nitrogen reservoirs in soil minerals, conservation mechanisms would be well developed. Carbon residence times of 50 to 150 years in woody structure and soil organic matter are consistent with the potential role of accumulated organic matter as an alternate energy base to support element release essential to establish new populations after a catastrophe. The small but rapid fluxes of nitrogen through the heterotrophs are sufficient to maintain autotroph processes. (See also W76-10266) (Auen-Wisconsin)
W76-10268

A PRELIMINARY COMPARTMENT MODEL OF THE NITROGEN CYCLE IN A DECIDUOUS FOREST ECOSYSTEM,
Idaho Univ., Moscow. College of Forestry, Wildlife and Range Sciences.
For primary bibliographic entry see Field 5B.
W76-10269

A MODEL OF WATER CONTENT AND EVAPORATION FOR HARDWOOD LEAF LITTER,
Western Carolina Univ., Cullowhee, N.C. Dept. of Biology.
For primary bibliographic entry see Field 2D.
W76-10270

SIMULATION OF NITROGEN DISTRIBUTION AND ITS EFFECT ON PRODUCTIVITY IN EVEN-AGED LOBLOLLY PINE PLANTATIONS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Theoretical Production Ecology.
For primary bibliographic entry see Field 5B.
W76-10271

A MODEL OF MINERAL-ELEMENT CYCLING FOR AN INVERTEBRATE FOOD WEB IN A SOUTHEASTERN HARDWOOD FOREST LITTER COMMUNITY,
Georgia Univ., Athens. Inst. of Ecology.
C. S. Gist, and D. A. Crossley.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, p 84-106. 5 fig, 58 ref, (CONF-740513). NSF AG-199, 40-1-3-69, AEC AT(38-1)641, NSF GB-7918.

Descriptors: *Model studies, *Decomposing organic matter, *Cycling nutrients, *Forests, *Potassium, *Calcium, Litter, Biodegradation, Invertebrates, Hardwood, Deciduous forests, North Carolina, *Food webs.
Identifiers: Forest litter.

A 10-compartment model of the movement of calcium and potassium in a hardwood forest floor through a cryptozoan food web substantiates the idea that fauna may regulate the litter breakdown on the forest floor without making any great demands on the content of the material itself. The compartments were litter and microflora, Diplopoda, Cryptostigmata, Orthoptera, Pulmonata, Collembola, medium Araneida, Coleoptera, small Araneida, and Mesostigmata. Two sets of models for each element were constructed: time-varying-coefficient models based on the summer state of the system and constant-coefficient models that used the annual integrated fluxes from the first set of models. The nutrient models were supplemented by two biomass models based on the annual potassium and calcium fluxes. Results indicated that the models based on the summer states overemphasized the contribution of mesofauna to litter decomposition. On the basis of the annual nutrient models, Cryptostigmata and Collembola were the most important saprovores and small Araneida and Mesostigmata were the most important predators. The biomass model, based on calcium fluxes, showed that saprovores accounted for possibly 20% of the total annual input. The saprovores in the potassium model accounted for only 1% of the total potassium flux from the litter compartment. (See also W76-10266) (Auen-Wisconsin)
W76-10272

FREQUENCY DISTRIBUTIONS OF RADIOCESIUM CONCENTRATIONS IN SOIL AND BIOTA,
Savannah River Ecology Lab., Aiken, S.C.
For primary bibliographic entry see Field 5B.
W76-10273

FACTOR ANALYSIS: AN EXPLORATORY TECHNIQUE APPLIED TO MINERAL CYCLING,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 5B.
W76-10274

A SPECIFIC-ACTIVITY AND CONCENTRATION MODEL APPLIED TO CESIUM MOVEMENT IN AN OLIGOTROPHIC LAKE,
Oak Ridge National Lab., Tenn.
H. A. Vanderploeg, R. S. Booth, and F. H. Clark.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 142-165. 7 fig, 2 tab, 23 ref.

Descriptors: *Mathematical models, *Radioisotopes, *Systems analysis, Movement, Dynamics, Cesium, Lakes, Sediment-water interfaces, Biological communities, Equations, *Oligotrophy, Eutrophication, Path of pollutants.
Identifiers: *Specific activity, Cs-137.

A linear systems-analysis model is designed to simulate the time-dependent dynamics of specific activity and concentration of radionuclides in aquatic systems. Transfer coefficients were determined for movement of Cs-137 in the components of an oligotrophic lake. These coefficients were defined in terms of basic environmental and ecological data so that the model can be applied to a wide variety of sites. Simulations with a model that ignored sediment-water interactions predicted much higher Cs-137 specific activities in the lake water and biota than did those with the complete model. Comparing Cs-137 concentrations predicted by the model with concentrations reported for the biota of an experimentally contaminated oligotrophic lake indicated that the transfer coefficients derived for the biota are adequate. A control diagram for simulating the flow of specific activity in a hypothetical oligotrophic lake is given. Specific activity in a compartment is controlled only by the flows entering the compartment and by loss of specific activity because of radioactive decay. In contrast, the amount of radionuclide in a lake compartment is regulated by both inflow and outflow. All organisms in the model, except fishes, can be treated as single compartments. Fishes are characterized by collective rate coefficients representing fast and slow compartments. (See also W76-10266) (Auen-Wisconsin)
W76-10275

THE ROLE OF PHYSICAL MODELING IN MARSH-ESTUARINE MINERAL-CYCLING RESEARCH,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab.
For primary bibliographic entry see Field 5B.
W76-10276

SYSTEMS MODELS FOR PHOSPHORUS MANAGEMENT IN FLORIDA,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
M. W. Gilliland.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems' 1975, (CONF-740513), p. 179-208. 7 fig, 2 tab, 38 ref. NOAA SG R/EA-3.

Descriptors: *Model studies, *Florida, *Phosphorus, *Systems analysis, Cycling nutrients, Estuaries, Mining, Aquatic productivity, Management.
Identifiers: Peace River(Fla), Phosphorus budget, Phosphorus mining, Phosphorus cycle, Charlotte Harbor(Fla).

The percent effect on the overall geochemical cycle of the phosphorus flows in peninsular Florida was determined by evaluating an overall state phosphorus budget model. Through mining, Florida is draining its phosphorus supply 125 times as fast as it is replaced. Phosphorus mobilized by mining was three orders of magnitude higher than the phosphorus cycling through its waterways. Digital computer simulation of the phosphorus flux in the Peace River Estuary showed the relative importance of projected changes in mining and population. Total phosphorus in the system ranged from 0.3 to 1.0 mg/l. Simulations indicated that daily mining-water discharges had little effect on total P concentrations and that periodic spills from slime ponds in the mining district elevated P levels for many years. Analog computer simulations of a productivity model for the Peace River mouth (Charlotte Harbor) indicated that high phosphorus levels keep nitrogen levels low (less than 0.1 mg/l), which limits productivity; if this conclusion is valid could the extreme excess of one nutrient make an aquatic system more oligotrophic. The other question posited is whether water quality control based on the percent effect of a given flow on the overall chemical cycle may be more effective than effluent standards based on concentrations. The research implies several P management contingencies in Florida. (See also W76-10266) (Auen-Wisconsin)
W76-10277

MINERAL CYCLING IN MARINE ECOSYSTEMS,
Georgia Univ., Athens. Dept. of Zoology.
L. R. Pomeroy.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 209-223. 2 fig., 60 ref.

Descriptors: *Biological communities, *Oceans, *Stability, *Succession, *Cycling nutrients, Marine algae, Coral, Niches, Tidal marshes, Marine plants, Estuaries, Reefs, Nitrogen, Phosphorus, Ecosystems.
Identifiers: *Marine ecosystems, Sea grass meadows.

The concept that abiotic spatial variables produce a mosaic of responses, reflected by stability and diversity of marine communities, is discussed. Considered are two marine grasses, coral reefs and oceanic plankton. The net diversity of a community, therefore, is the result of population interactions taking place under temporally and spatially varying nutrient regimes and constantly interrupted by physical destruction of portions of the community which will have varying degrees of insularity with respect to repopulation. It is postulated that the most diverse communities are not necessarily the most stable; rather they have moderate resistance and resiliency. Where essential elements are present in excess of needs, populations of high stability develop; where nutrients are adequate, communities of intermediate stability develop; where nutrients are inadequate and where the specific limiting elements may change with time and space, communities are unstable. Disturbance is a significant cause of diversity in coral reefs and their successional response is comparatively slow; in planktonic communities adjacent patches of water differing in nutrient-limitation states may produce a successional mosaic. Thus, intertidal Spartina meadows are the most stable and least diverse; coral reefs are the most diverse, and appear to have intermediate stability; planktonic communities are the most unstable, have moderate to high diversity. (See also W76-10266) (Auen-Wisconsin)
W76-10278

DISTRIBUTION OF COPPER AND ZINC IN OYSTERS AND SEDIMENTS FROM THREE COASTAL-PLAIN ESTUARIES,
Virginia Inst. of Marine Science, Gloucester Point.
R. J. Huggett, F. A. Cross, and M. E. Bender.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 224-238, 7 fig, 21 ref. NSF-RANN GI-34-869, AT(49-7)-5.

Descriptors: *Shellfish, *Metals, *Estuaries, Oysters, Copper, Zinc, Bottom sediments, North Carolina, Virginia, Salinity, Trace elements, Rivers, Chesapeake Bay, Saline water-freshwater interfaces.
Identifiers: Newport River(NC), Rappahannock River(Va), York River(Va), Bogue Sound(NC).

A concentration gradient exists in oyster samples from the Newport River estuary, North Carolina, and in the Rappahannock and York estuaries, Virginia, with progressively higher concentrations of either copper or zinc being found in progressively fresher waters, suggesting that a natural phenomenon is responsible. Limited data did not show a concentration gradient for copper, cadmium or zinc in water as a function of salinity. That the sediments serve as a copper and zinc source to oysters was not substantiated. If gradients in concentration of dissolved and particulate copper and zinc are eliminated as possible factors controlling the inverse relationship between salinity and Cu-Zn concentrations in oysters, the following hypotheses are postulated: (1) That zinc may be assimilated from the environment along with calcium by a relative nonspecific ion-transport mechanism to satisfy the organisms' large calcium requirements; (2) at higher salinities the more abundant cations in seawater may be outcompeting the less abundant Cu and Zn for binding sites in the soft tissues; (3) that chelation or complexation of the metals in solution by natural organics, such as fulvic acids, make the elements more available to oysters. As none of these hypotheses can be validated, the metals' bioavailability to organisms, and the consequences of increased releases of metals to estuarine systems cannot be evaluated. (See also W76-10266) (Auen-Wisconsin)
W76-10279

EFFECTS OF ENVIRONMENTAL LEVELS OF MERCURY AND CADMIUM ON RATES OF METAL UPTAKE AND GROWTH PHYSIOLOGY OF SELECTED GENERA OF MARINE PHYTOPLANKTON,
Skidaway Inst. of Oceanography, Savannah, Ga.
L. B. Sick, and H. L. Windom.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 239-249, 3 fig, 2 tab, 18 ref. NSF GX-33615.

Descriptors: *Marine algae, *Heavy metals, *Absorption, Mercury, Cadmium, Toxicity, Inhibition, Georgia, Growth rates.
Identifiers: Nitzschia closterium, Carteria, Dunaliella tertiolecta.

This investigation was conducted on Nitzschia closterium, Carteria, and Dunaliella tertiolecta to determine both uptake rates and biological effects of mercury and cadmium to the levels presently occurring in the estuarine and coastal waters of Georgia. Uptake rates of labeled mercury and cadmium were found to be dependent on metal concentrations, length of exposure, and algal genus. Mercury concentrations above 40 ng/l did not significantly increase uptake rates. Cadmium uptake rates were one to two orders of magnitude lower than Hg and were directly proportional to the metal concentration between 20 to 80 ng/l. Nitzschia had higher uptake rates for both metals than Carteria or Dunaliella. Mercuric ion concentration between 30 and 350 ng/l significantly depressed algal growth. Lowered cell-division rates were accompanied by decrease in total cellular nitrogen and lipid and increases in carbon and Hg concentrations. The kinetic processes involved in metal adsorption into algal cells were probably inhibited by exposure to Hg. Differences to metal uptake rates may be attributed to enzyme kinetics, relative surface area to weight ratio of the populations, and/or general physiological adaptations of each genus to culture conditions. Changes in the algal cell chemical composition and decreased productivity caused by naturally occurring Hg levels could conceivably affect growth and productivity at higher trophic levels. (See also W76-10266) (Auen-Wisconsin)
W76-10280

THE ROLE OF SPARTINA ALTERNIFLORA IN THE FLOW OF LEAD, CADMIUM, AND COPPER THROUGH THE SALT-MARSH ECOSYSTEM,
Skidaway Inst. of Oceanography, Savannah, Ga.
W. M. Dunstan, H. L. Windom, and G. L. McIntire.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 250-256. 2 fig., 1 tab., 8 ref. NSF GX-33615, SG R/EE-2 (04-3-158-6).

Descriptors: *Heavy metals, *Rooted aquatic plants, *Salt marshes, *Estuaries, Lead, Cadmium, Copper, Georgia, Southeast U.S. Path of Pollutants.
Identifiers: *Spartina alterniflora.

Laboratory measurements indicated that Spartina alterniflora plays only a minor role in the cycle of lead, cadmium and copper in estuarine systems. The plants' response to high concentrations of these metals was: complete mortality to copper; inhibition and growth modification to lead; and no growth modification due to cadmium. The role of Spartina in controlling the flux of metals through the systems is negligible, as a very small portion of the metals discharged by rivers is trapped in the marsh mud or in Spartina. Above 17% the Cd is deposited in the sediment and about 3% occurs in the Spartina crop; 80% of the Cd bypasses the marsh system and enters coastal waters. About 3% of Cu was in Spartina, 22% in the sediment, and 7% flowing through the marsh system. The mean concentration of Cd in sediments surrounding Spartina was 1.19 ppm, whereas the leached fraction contained 0.45 ppm, which is close to the mean of 0.61 ppm found in the plant. The amount available to Spartina represents a very small portion of Cd and Cu in the total system. Toxic levels of lead are an order of magnitude higher than those now occurring in the environment. Increased levels of these metals would have little effect on Spartina. (See also W76-10266) (Auen-Wisconsin).
W76-10281

HEAVY-METAL CONCENTRATIONS IN SELECTED GEORGIA ESTUARINE ORGANISMS WITH COMPARATIVE FOOD-HABIT DATA,
Skidaway Inst. of Oceanography, Savannah, Ga.
R. R. Stickney, H. L. Windom, D. B. White, and F. E. Taylor.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystem,' 1975. (CONF-740513), p. 257-267. 1 fig., 3 tab., 22 ref. NSF GX-33615.

Descriptors: *Heavy metals, *Absorption, *Fish, *Estuary, Fish food organisms, Fish diets, Crustaceans, South Carolina, Georgia, Florida, Cadmium, Copper, Lead, Zinc.
Identifiers: Silver perch, Weakfish, Spot, Atlantic croaker, Star drum, Oscillated flounder, Bay whiff, Fringed flounder, Windowpane, Oyster toadfish, Blackcheck tonguefish.

Tissue levels of cadmium, copper, lead, mercury, and zinc were determined for 11 common benthic fishes in estuaries between Georgetown, South Carolina and Jacksonville, Florida, specifically, the families of Sciaenidae, Bothidae, Batrachoididae and Cynoglossidae. Analyses for the same metals were run on selected invertebrates that are important food organisms to the fishes studied. Comparison between heavy metals levels and food habits of the fishes generally indicated no positive correlation, although high levels of mercury and lead in Opsanus tau (oyster toadfish) appeared to be associated with elevated levels in crabs, its major food source. Copper and zinc were commonly higher in the tissues of invertebrates than in the fish that fed upon them. The level of trace metals in organisms from different trophic levels apparently depends more on physiological processes within each organism than on the metal concentration in the food. This relationship probably will not apply in instances where pollution loads of heavy metal concentrations high enough to overcome homeostatic mechanisms. (See also W76-10266) (Auen-Wisconsin).
W76-10282

CONCENTRATIONS OF TOTAL MERCURY AND METHYL MERCURY IN FISH AND OTHER COASTAL ORGANISMS: IMPLICATIONS TO MERCURY CYCLING,
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5B.
W76-10283

NITROGEN REGENERATION BY THE CTENOPHORE MNEMIOPSIS LEIDYI,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
P. Kremer.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975 (CONF-740513), p. 279-290. 4 fig., 3 tab., 31 ref.

Descriptors: *Cycling nutrients, *Nitrogen, *Estuaries, *Zooplankton, Rhode Island, Ammonia, North Carolina, Virginia, Florida.
Identifiers: *Ctenophores, Comb jelly, Narragansett Bay(RI), York River estuary(VA), Pamlico River estuary(NC), Biscayne Bay(Fla).

Investigative results of nitrogen excretion rates for the comb jelly (Mnemiopsis leidyi) in Narragansett Bay, R. I., and their effect on nitrogen flux are discussed. The flux is compared with other zooplankton excretion rates in the York River estuary (Va.), Pamlico River estuary (N.C.), and Biscayne Bay (Fla.), and evaluated with respect to other nitrogen sources. Respiration is not discussed except to note that oxygen consumption and ammonia excretion agreed closely at all temperatures, yielding an oxygen to nitrogen ratio by atoms of 13:1 with an overall correlation coefficient for all observations of 0.98. Based on biomass, nitrogen excretion, primarily ammonia, was constant over time for individuals, and a direct linear function of population sample at a given temperature. The excretion rates were temperature dependent, ranging from 0.4 to 1.5 microgram atoms of ammonia, per gram of dry weight per hour between 15.8 and 24.5C. The 1971 maximum was about 60 microgram atoms ammonia/cu m/day compared to a 1972 peak of 10 microgram atoms cu m/day. The excretion rates for the four estuaries were comparable to that of other zooplankton during ctenophore abundance. However, both these nitrogen sources are small when compared with the estimated flux from the Narragansett Bay benthos in late summer. (See also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10284

THE ROLE OF BENTHIC COMMUNITIES IN THE NITROGEN AND PHOSPHORUS CYCLES OF AN ESTUARY,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
S. S. Hale.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 291-308. 7 fig., 1 tab., 42 ref. EPA T900140-04.

Descriptors: *Crustaceans, *Cycling nutrients, *Estuaries, *Benthos, *Nitrogen cycle, Metabolism, Ammonia, Nitrates, Nitrites, Phosphates, Water temperature, Amphipoda, Clams, Sediment-water interfaces, Rhode Island, Annelids, Phosphorus.
Identifiers: Narragansett Bay(RI), Bivalves.

The net sediment-water flux of ammonia, nitrate, nitrite, and inorganic phosphate in Narragansett Bay, R. I., was quantified by the nutrient regeneration role of the benthos. Preliminary attempts were made to determine the factors controlling the fluxes. Bottom chambers were used to obtain in situ measurements from an Ampelisca abdita (amphipod) community on coarse sand, a Nepthys incisa-Nucula annulata (polychaete-bivalve) community on a sandy-silt bottom, and a Mercenaria mercenaria (bivalve) community on sandy silt. Oxygen uptake was used as a measure of metabolism. Over a temperature range from 3.2 to 22.4C, ammonia flux at the sediment surface varied from -4.28 to 276.10 micromoles sq m/hr. Nitrate was transported in both directions across the sediment-water interface, varying from -66.31 to 43.43 micromoles/hr. Nitrite flux was relatively unimportant. Phosphate uptake and release ranged from -9.43 to 41.63 micromoles sq m/hr. Few significant differences were found among the three communities. Temperature exerted a strong influence on the fluxes of ammonia and phosphate. No strong correlations were found between nutrient fluxes and the concentrations of nutrients in the overlying water (with the possible exception of phosphate flux in December and January). The fluxes measured can have significant effects on the nutrient concentrations of the overlying water. (See also W76-10266) (Auen-Wisconsin).
W76-10285

RIVER INPUT OF INORGANIC PHOSPHORUS AND NITROGEN TO THE SOUTHEASTERN SALT-MARSH ESTUARINE ENVIRONMENT,
Skidaway Inst. of Oceanography, Savannah, Ga.
H. L. Windom, W. M. Dunstan, and W. S. Gardner.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' (CONF-740513), p. 309-313. 1 fig, 1 tab, 12 ref. EPA R-800372.

Descriptors: *Salt marshes, *Phosphorus, *Nitrogen, *Rivers, South Carolina, Florida, Southeast U.S., Georgia, Rooted aquatic plants, Runoff.
Identifiers: Spartina alterniflora, Nutrient sources, Pee Dee River(SC), Black River(SC), Santee River(SC), Cooper River(SC), Savannah River(Ga), Ogeechee River(Ga), Altamaha River(Ga), Satilla River(Ga), St. Johns River(Fla), Cord grass.

The Pee Dee, Black, Santee, and Cooper Rivers in South Carolina; the Savannah, Ogeechee, Altamaha, and Satilla Rivers in Georgia; and the St. Johns River in Florida account for 95% of the total discharge of fresh water to the salt-marsh estuaries between Georgetown, South Carolina and Jacksonville, Florida. The supply of inorganic phosphorus and nitrogen to the ecosystem was determined by bimonthly analyses of phosphorus, ammonia, and nitrate content of the rivers. The annual supply of inorganic phosphorus is adequate to supply the total phosphorus required by the approximately one million acres of Spartina salt marsh. The annual supply of inorganic nitrogen can supply only about 20% of that required, suggesting that much of the nitrogen in the vegetation is recycled. Input of nitrogen by atmospheric fallout is probably insignificant, as is the river supply of organic and particulate nitrogen. Computations indicated that the annual river inputs of N and P to the marshes are 220 and 10 mg atoms/sq m, respectively. If it assumed that the suspended load (averaging 15 mg/l) contains about 1% of available N, the total annual supply of N is estimated at 375 mg atoms/N sq m in addition to that supplied as dissolved nitrate and ammonia. The indication is that nitrogen limits productivity in these environments. (See also W76-10266) (Auen-Wisconsin).
W76-10286

NUTRIENT FLUX AND CYCLING IN FRESHWATER ECOSYSTEMS,
Cornell Univ., Ithaca, N. Y. Section of Ecology and Systematics.
G. E. Likens.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 314-348. 8 fig., 10 tab., 96 ref.

Descriptors: *Cycling nutrients, *Lakes, *Streams, *Input-output analysis, Biochemistry, Geochemistry, Gases, Air-water interfaces, Nitrogen, Phosphorus, Carbon, Precipitation(Atmospheric), Runoff, Sedimentation.
Identifiers: *Nutrient flux, *Nutrient budget.

The flux and cycling of nutrients, the contribution of nutrients by biogeochemistry, and their impact on an aquatic ecosystem nutrient budget are discussed. The ecological implications of adding nutrients in intermittent large concentrations and in small volumes as opposed to adding the same total imput in continuously smaller concentrations but in large volumes and over long periods are not well known, but have important ramifications for the management of point and nonpoint sources of nutrients and pollutants. To gain maximum understanding, studies should be done of nutrient fluxes for whole ecosystems. Real progress in understanding aquatic ecosystems will depend on the ability to relate and integrate nutrient-flux and cycling parameters, e.g., knowledge of internal nutrient-turnover rates is critical to understanding nurient availability in lakes, but these rates must be dynamic--linked to the continuous flux of ecosystem inputs and outputs. Turnover rates for seston vary from minutes for phosphorus to hours and days for nitrogen, and hours and weeks for carbon. In contrast, nutrient residence times for total ecosystems usually range from weeks to years, depending on rates of sedimentation, mixing, and throughput. Integrating these variables should lead to new levels of sophistication in diagnosing and managing aquatic ecosystems. (See also W76-10266) (Auen-Wisconsin).
W76-10287

THE SANTEE SWAMP AS A NUTRIENT SINK,
South Carolina Univ., Columbia. Dept. of Biology.
W. M. Kitchens, J. M. Dean, L. H. Stevenson, and J. H. Cooper.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975 (CONF-740513), p. 349-366. 7 fig, 25 ref.

Descriptors: *Nutrient removal, *Water purification, *Swamps, Southeast U.S., Streams, Freshwater marshes, Phosphorus compounds, Nitrogen compounds, Coliforms, Self-purification, Pollution abatement, South Carolina.
Identifiers: *Santee Swamp(SC), Nutrient sink, Wateree River(SC), Congaree River(SC).

The Upper Santee Swamp, South Carolina, extending from the confluence of the Congaree and Wateree Rivers, was studied for its role in the reduction of nutrient loads and fecal coliforms. The two rivers are heavily polluted from sewage discharges and agricultural runoff but Lake Marion, an impoundment five miles downstream of the rivers' confluence has not shown eutrophication symptoms typical of shallow impoundments receiving comparable nutrient loads. The general trend observed, for both total and reactive phosphates, a 50% reduction in concentrations as the water passed from the rivers to the lower swamp provinces, depending on flow. Nitrate concentrations, consistently high in both rivers, was essentially unaltered in passage through the swamp. The flow through the swamp during the study period was usually a mass sheet over the floodplain floor, with no additional stream runoff inputs, therefore concentration changes are definitely not due to dilution. The nutrient sink is considered primarily biological, with possible total phosphates adsorbed to suspended silts and clays. There was also a significant reduction in bacterial counts, including fecal coliforms, with little or no oxygen depletion as the waters coursed over the swamp. (See also W76-10266) (Auen-Wisconsin).
W76-10288

THE ROLE OF EMERGENT MACROPHYTES IN MINERAL CYCLING IN A FRESHWATER MARSH,
Wisconsin Univ., Milwaukee. Dept. of Botany.
J. M. Klopatek.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 367-393. 9 fig., 5 tab., 53 ref.

Descriptors: *Cycling nutrients, *Rooted aquatic plants, *Freshwater marshes, *Nutrient removal, Productivity, Wisconsin, Wetlands, Nitrogen, Phosphorus, Soil chemistry, Water chemistry, Cattails, Energy transfer, Bullrushes, Willow trees.
Identifiers: Theresa Marsh(Wis), Emergent macrophytes, Burr reed, Sedge, Canary grass.

Theresa Marsh, Wisconsin, was investigated by examining both the ontogeny of the species and their patterns of nutrient uptake and release. Three variable linear regression equations were employed to compare the changes in the amount of nutrients (g/sq m) in the belowground and the aboveground standing crops and the level of soil nutrients in monotypic stands of Typha latifolia, Scirpus fluviatilis, and Carex lacustris. The highly significant correlation values between both Scirpus and Carex (and to a lesser extent Typha) and total soil nitrogen was somewhat surprising since, in continually waterlogged soils, ammonia is regarded as the sole plant-available nitrogen. The magnitude of correlations with phosphorus indicated that the emergent macrophytes are per-

haps the factor controlling the flux of phosphorus in the soil during the growing season. Total nitrogen and available phosphorus in the marsh soil appear to be adequate; the macrophytes are acquiring their nutrients from the soil, and control the nutrients within the soil during the growing season. Denitrification reactions appeared to occur throughout the year, especially during summer. Potassium, calcium, and magnesium concentrations throughout the year appeared dependent on the macrophyte uptake and leaching losses, total respiration in the marsh, and the physical and chemical characteristics of the water. (See also W76-10266) (Auen-Wisconsin).
W76-10289

CHANGES IN WATER CHEMISTRY AND PRIMARY PRODUCTIVITY OF A REACTOR COOLING RESERVOIR (PAR POND),
DuPont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
L. J. Tilly.
In: Proceedings of a symposium 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 394-407. 4 fig., 5 tab., 25 ref.

Descriptors: *Primary productivity, *Water chemistry, *Impoundments, *Water cooling, Nuclear reactors, Eutrophication, Ions, South Carolina, Eutrophication.
Identifiers: *Par Pond(SC), Savannah River(SC).

Unsuspected changes in Par Pond, South Carolina, in its characteristics, primary productivity, and water chemistry, which are apparently related to reactor operations are summarized and possible connections to reactor operations and consequences for the reservoir community are discussed. Initially the primary productivity increased sixfold, and the dissolved solids doubled. The dissolved solids increase appears to have been caused by addition of makeup water from the Savannah River and by evaporative concentration during the cooling process. As the dissolved solids concentrations and the conductivity of makeup water leveled off, the primary productivity stabilized. Major cation and anion concentrations generally followed total dissolved solids through the increase and plateau; however, silica concentrations declined steadily during the initial periods of increased plankton productivity. Standing crops of net seston and centrifuge seston did not increase during this initial period. The collective data show the effects of thermal input to a cooling reservoir, illustrate the need for limnological studies before reactor siting, and suggest the possibility of using makeup water additions to power reactor cooling basins as a reservoir management tool. Continuing observations will be made of the growth rates of top carnivores during the current leveling and decline in plankton productivity to explain the turnover increases of the lower trophic levels but not in the standing crops. (See also W76-10266) (Auen-Wisconsin).
W76-10290

MINERAL PATHWAYS IN SMALL APPALACHIAN STREAMS,
Georgia Power Co., Atlanta. Environmental Div.
For primary bibliographic entry see Field 5B.
W76-10291

ORGANICALLY COMPLEXED COPPER, ZINC, AND CHELATING AGENTS IN RIVERS OF WESTERN PUERTO RICO,
Puerto Rico Nuclear Center, Mayaguez.
For primary bibliographic entry see Field 5B.
W76-10292

UPTAKE AND ELIMINATION OF RADIOTUNGSTEN IN BLACK BULLHEADS,
Virginia Commonwealth Univ., Richmond. Dept. of Biology.
J. R. Reed.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 435-444. 2 fig., 2 tab., 12 ref.

Descriptors: *Radioisotopes, *Bullheads, *Animal metabolism, *Absorption, Fish, Exudation, Persistence.
Identifiers: *Tungsten, Elimination.

Radiotungsten uptake and turnover were studied in a poikilothermic vertebrate, the black bullhead, Ictaluras melas after accumulation from water and food. Whole-body activity reached a plateau after the fish were in labeled water for 4 days at 14C with elimination varying according to the manner of uptake. Fish which accumulated radiotungsten from water had a single exponential component of elimination with a biological half-life of 2.75 days. When fish received the radioisotope in a single feeding, activity was lost at two rates: one component had a biological half-life of 14 hours and the second, six days. The bones, flesh, skin, gills, guts and blood contained the greatest percentage of whole-body activity after one day of uptake from water. When activity losses were followed for 16 days, all tissues examined showed a rapid decrease, with biological half-lives of 2.1-8.0 days. Bone had the longest biological half-life (8.0 days). Flesh, gills, bones, and guts contained 78.6% of the total activity after 8 days. Bone contained 32.2% of the whole-body activity initially and 69.8% after 16 days elimination. Radiotungsten distribution in bullheads is similar to the distribution in rats. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10293

MOBILIZATION OF MERCURY FROM FRESHWATER SEDIMENTS BY HUMIC ACID,
Georgia Univ., Athens. Dept. of Zoology.
R. W. Miller, J. E. Schindler, and J. J. Alberts.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 445-451. 2 fig., 1 tab., 12 ref. EPA R-800427.

Descriptors: *Mercury, *Freshwater, *Sediments, *Humic acids, Sulfides, Translocation, Estuaries, Absorption, Hydrogen ion concentration.
Identifiers: Mercury mobilization.

Sediments rapidly absorb inorganic mercury. When sulfides are present, insoluble mercuric sulfide is formed. Bacteria may form methylmercury, which may be released or changed by demethylating bacteria to elemental mercury. Humic materials in sediment reduce mercury. With excess humic acid, elemental mercury is released from sediments; decreases in humic acid decrease the rate and amount of elemental mercury released. Large increases in humic acids relative to mercury inhibit the reaction. Reduction of ionic to elemental mercury is mediated by humic acids. Strong complexation of mercury by humic acid may also occur. Excess humic acid binds all mercury, immobilizing it in ionic or elemental forms. When sediment humic acid concentrations are high, small amounts of mercury are complexed and elemental mercury is not released. Sediments with lower organic contents release elemental mercury. When sediment humic acid concentrations remain constant, mercury increases more than can be complexed and elemental mercury is released. If mercury additions cease, excess mercury is reduced and mercury bound to humic acid remains in sediment. Sulfides probably cause permanent removal of mercury to the sediment. Usually mercury is immobilized in sediment with only small amount available for release as elemental or methylmercury. (See also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10294

REDISTRIBUTION OF CESIUM-137 IN SOUTHEASTERN WATERSHEDS,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W76-10295

RADIOCESIUM CYCLING IN VEGETATION AND SOIL,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W76-10296

ACCUMULATION AND MOBILITY OF CESIUM IN ROOTS OF TULIP POPLAR SEEDLINGS,
Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries, and Wildlife Development.
For primary bibliographic entry see Field 5B.
W76-10297

RADIOCESIUM LEVELS IN VEGETATION COLONIZING A CONTAMINATED FLOOD PLAIN,
Savannah River Ecology Lab., Aiken, S.C.
C. T. Garten, L. A. Briese, R. A. Geiger, R. R. Sharitz, and M. H. Smith.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 489-497, 2 fig, 1 tab, 17 ref. AT(38-1)-819, AT(38-1)-310, AT(38-1)-708.

Descriptors: *Cesium, *Radioisotopes, *Vegetation, Soil contamination, Environmental effects, Radioactive wastes, Water pollution, South Carolina, Nuclear reactors, Leaves, Regression analysis, Sediments, Coastal Plains, Bulrushes, Willow trees, Shrubs, Absorption, Southeast U.S.
Identifiers: *Steel Creek(SC), Herbaceous plants, Stems, Fruits.

Radionuclides had been released into Steel Creek at the Atomic Energy Commission's Savannah River Plant, South Carolina, from 1961 to 1970. Cesium-137 is considered to have the greatest biological significance because of its long half-life. Steel Creek soils had low radiocesium fixing capacities but cesium might be concentrated by vegetation, so radiocesium levels were measured in dominant plant species. Radiocesium concentrations in component parts of woody and herbaceous plants were log normally distributed. Leaves and stems of herbaceous plants (Andropogon and Scirpus cyperinus) contained more radiocesium than those of woody plants (Alnus serruleta, Myrica cerifera, and Salix nigra). Andropogon and Alnus fruits had higher concentration than leaves or stems. Fruit and leaf concentrations could be significantly correlated with stem levels in most species sampled. Levels in plant species and their component parts were highly variable but predictable at local levels. Mean levels in plant parts exceeded mean soil concentrations, indicating radiocesium concentration by vegetation. Simple regression equations were adequate predictors of leaf concentrations from stem concentrations in all plant species studied. With large radiocesium releases, uptake by vegetation from contaminated sediments might be a greater environmental problem in southeastern coastal plain streams than in ecosystems where radiocesium would be more actively fixed by soils. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10298

SEASONAL VARIATION IN RADIOCESIUM CONCENTRATIONS IN THREE TREE SPECIES,
Savannah River Ecology Lab., Aiken, S.C.
C. T. Garten, L. A. Briese, R. R. Sharitz, and J. B. Gentry.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 498-508. 1 fig., 2 tab., 15 ref. AT(38-1)-708, AT(38-1)-819.

Descriptors: *Cesium, *Radioisotopes, *Trees, Leaves, Willow trees, Distribution, South

Carolina, Root systems, Nuclear wastes, Nuclear reactors, Seasonal, Soil contamination, Southeast U.S., Absorption, Leaching, Translocation, Statistical methods, Food chains, Environmental effects.
Identifiers: *Steel Creek(SC), Stems, Wax myrtle, Black willow, Tag alder.

Radiocesium dynamics were studied in leaves and stems of black willow (Salix nigra), wax myrtle (Myrica cerifera), and tag alder (Alnus serrulata) inhabiting the vicinity of Steel Creek, which received production-reactor effluents from the Savannah River Plant, South Carolina. Willow and myrtle leaf radiocesium levels were highest in spring, then declined during the growing season; stem levels remained unchanged or increased slightly. Seasonal changes occurred in alder parts and varied with site studied. Relationships between parts were consistent within species and collecting sites in summer. Radiocesium was highest in roots, then leaves, and lowest in stems. Mean soil to plant-part concentration factors in summer ranged from 0.9-7.6 and species means across leaves, stems, and roots averaged 2.1, 3.8, and 6.2 for alder, willow, and myrtle, respectively. Radiocesium transport from foliage to roots and soil was not demonstrated, but increasing concentrations in willow and some alder stems during the growing season suggested that stem tissue resorb from leaves. Leaching from willow and alder leaves was probably more important than translocation in reducing concentrations in spring and summer. Due to high leaf concentrations in spring and summer, herbivores ingest more radiocesium. Translocation bark into woody tissues in fall retains radiocesium in the ecosystem and reduces cesium loss in leaf fall. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10299

DISTRIBUTION OF RADIOCESIUM IN VEGETATION ALONG A CONTAMINATED STREAM,
Savannah River Ecology Lab., Aiken, S.C.
For primary bibliographic entry see Field 5B.
W76-10300

EFFECTS OF AGE, SEX, AND PELAGE PHENOTYPE ON THE ELEMENTAL COMPOSITION OF THE OLD-FIELD MOUSE,
Savannah River Ecology Lab., Aiken, S. C.
For primary bibliographic entry see Field 5A.
W76-10301

PREDICTION OF ELEMENTAL CONTENT IN THE OLD-FIELD MOUSE,
Savannah River Ecology Lab., Aiken, S. C.
For primary bibliographic entry see Field 5A.
W76-10302

CHEMICAL COMPOSITION OF WHITE-TAILED DEER: WHOLE-BODY CONCENTRATIONS OF MACRO- AND MICRONUTRIENTS,
Savannah River Ecology Lab., Aiken, S. C.
J. G. Wiener, I. L. Brisbin, and M. H. Smith.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 536-541. 1 tab., 20 ref. AT(38-1)-819, AT(38-1)-708.

Descriptors: *Deer, *Chemical properties, *Trace elements, Calcium, Potassium, Magnesium, Sodium, Phosphorus, Copper, Iron, Manganese, Molybdenus, Zinc, Nitrogen, Regression analysis, Energy budget, South Carolina, Hunting, Biomass, Cycling nutrients, Forests.
Identifiers: White-tailed deer.

The wet- and dry-weight concentrations of macronutrients (calcium, potassium, magnesium, nitrogen, sodium, and phosphorus) and micronutrients (copper, iron, maganese, molybdenum, and zinc) were measured in whole-body samples of 27 white-tailed deer (Odocoileus virginianus). Linear regression of nutrient concentrations on body weight indicated no significant change in concentration with respect to body weight. Coefficients of variation for the macronutrient concentrations averaged less than those for micronutrient concentrations. Only magnesium, manganese, and molybdenum had coefficients of variation greater than 25%. Coefficients of variation for wet- and dry-weight concentrations were similar for each element. In the vicinity of Savannah River Plant, South Carolina, there are approximately 0.16 deer/ha with a wet value of approximately 44.54 kg/deer, producing a wet-weight biomass density of 7.13 kg/ha. Since 1967 deer hunts have removed about 1.15 deer/sq km/year or 0.52 kg wet-weight biomass/ha/year. Nutrient exportation was calculated on a per hectare scale using wet-weight concentrations and the above biomass value. Nutrient standing crops of deer are small compared to those of primary producer components of temperate forest ecosystems. Annual loss of nutrients by deer harvest is negligible compared with annual nutrient budgets of southeastern forests. (See also W76-10266) (Buchanan-Davidson-Wisconsin)
W76-10303

RADIOCESIUM CONCENTRATIONS IN WHOLE-BODY HOMOGENATES AND SEVERAL BODY COMPARTMENTS OF NATURALLY CONTAMINATED WHITE-TAILED DEER,
Savannah River Ecology Lab., Aiken, S. C.
I. L. Brisbin, and M. H. Smith.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 542-556. 2 fig., 3 tab., 20 ref. AEC AT(38-1)-310, AT(38-1)-708.

Descriptors: *Cesium, *Radioisotopes, *Absorption, *Deer, *Distribution, South Carolina, Correlation analysis, Analytical techniques, Retention.
Identifiers: White-tailed deer, Deer tissues, Bone, Organs, Muscle.

Radiocesium concentrations were studied in body compartments of white-tailed deer at the Atomic Energy Commission's Savannah River Plant, South Carolina. The highest levels (average of 50-70 picocuries radiocesium/g dry weight) were in skeletal muscle, feces, kidneys, and adrenal tissue; bone and liver had the lowest values. Except for feces and rumen contents, most tissues and organs showed positive linear correlations between their radiocesium levels. Radiocesium in brain, liver, and lungs increased at slower rates than the whole body, while adrenal and kidney tissues increased at faster rates. Analyses of whole-body homogenates showed that deer averaged 9.91 picocuries radiocesium/g whole body wet weight. These values were best predicted from skeletal muscle radiocesium contents using the relationship: picocuries radiocesium/g dry Whole body weight equals 3.33 + 0.60 picuries/g dry skeletal muscle. Calculation of a weighted predictive index indicated that skeletal muscle concentrations best predicted the overall pattern and levels of radiocesium distribution in all body compartments. Radiocesium concentrations in brain, heart,and liver followed muscle in order of predictive ability. Use of a single organ or tissue sample to estimate body contents and distribution of other environmental contaminants is discussed. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10304

RELATIONSHIP BETWEEN POTASSIUM INTAKE AND RADIOCESIUM RETENTION IN THE REINDEER,
Alaska Univ., College. Inst. of Arctic Biology.
D. G. Holleman, and J. R. Luick.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 557-563. 2 fig., 1 tab., 12 ref.AEC AT(45-1)-2229

Descriptors: *Potassium, *Cesium, *Radioisotopes, Lichens, Food habits, Sorption, Fallout, Retardants, Retention, Summer, Winter, *Absorption.
Identifiers: *Reindeer.

To determine the effects of potassium intake on radiocesium retention in reindeer when the animals were maintained on a winter diet of lichens, several reindeer (Rangifer tarandus sibericus) were fed lichen plus potassium ad libitum, then injected intravenously with cesium-134. Potassium added to the diet markedly decreased radiocesium retention, suggesting that seasonal changes in cesium retention observed earlier in reindeer might be largely caused by nutritional factors. A 20-fold increase in dietary potassium caused a 2-fold decrease in radiocesium retention. An equation describes cesium retention as the sum of a fast exponential component and a slow exponential component. The increased potassium intake affected the slow component, especially. A decrease in cesium retention due only to increase in potassium intake would necessitate a 20 to 100-fold increase in intake from winter to summer; this could be achieved by consuming food with higher potassium contents, increasing food intake, and/or using high potassium mineral licks. Normally free-grazing reindeer consume more than ten times as much potassium in the summer; also food intake probably increases in the summer. Mineral licks would also be more available and used more in the summer when reindeer graze on ranges free of snow and ice. (See also W76-10266) (Buchanan-Davidson-Wisconsin))
W76-10305

SEASONAL AND ANNUAL VARIATIONS IN THE QUANTITIES OF NITROGEN, POTASSIUM, PHOSPHORUS, MAGNESIUM, CALCIUM, AND MANGANESE REACHING THE FOREST FLOOR AS MAST IN PENNSYLVANIA AND VERMONT FORESTS,
Massachusetts Univ., Amherst. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W76-10306

FALLOUT CESIUM-137 AND MINERAL-ELEMENT DISTRIBUTION IN FOOD CHAINS OF GRANITIC-OUTCROP ECOSYSTEMS,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 5B.
W76-10307

RESOURCE PARTITIONING IN LEAF-LITTER FAUNAS FROM HARDWOOD AND HARDWOOD-CONVERTED-TO-PINE FORESTS,
Battelle-Columbus Labs., Ohio. Ecology and Ecosystems Analysis Section.
For primary bibliographic entry see Field 5B.
W76-10308

FOREST-FLOOR NUTRIENT DYNAMICS IN SOUTHERN APPALACHIAN HARDWOOD AND WHITE PINE PLANTATION ECOSYSTEMS,
Environmental Protection Agency, Washington, D. C. Office of Environmental Sciences.
For primary bibliographic entry see Field 5B.
W76-10309

LITTER PRODUCTION, DECOMPOSITION, AND NUTRIENT CYCLING IN A MIXED HARDWOOD WATERSHED AND A WHITE PINE WATERSHED.
Georgia Univ., Athens. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W76-10310

CERIUM AND COBALT MOVEMENT WITH LITTER LEACHATE IN A FOREST SOIL,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
For primary bibliographic entry see Field 5B.

W76-10311

LEACHING OF NUTRIENTS FROM LEAVES OF SELECTED TREE SPECIES IN NEW HAMPSHIRE,
New Mexico Univ., Albuquerque. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W76-10312

PHOSPHORUS CYCLING IN A MARYLAND DECIDUOUS FOREST SUBJECTED TO VARIOUS LEVELS OF MINERAL-NUTRIENT LOADING,
Smithsonian Institution, Rockville, Md. Radiation Biology Lab.
For primary bibliographic entry see Field 5B.
W76-10313

BASE-LINE DATA ON EVERGLADES SOIL-PLANT SYSTEMS: ELEMENTAL COMPOSITION, BIOMASS, AND SOIL DEPTH,
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
B. G. Volk, S. D. Schemnitz, J. F. Gamble, and J. B. Sartain.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 658-672. 1 fig, 3 tab, 21 ref.

Descriptors: *Chemical properties, *Florida, *Freshwater marshes, *Trace elements, *Heavy metals, *Marsh plants, Soil types, Baseline studies, Muck soils, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sodium, Copper, Iron, Manganese, Zinc, Cobalt, Strontium, Lead, Nickel, Chromium, Aluminum, Silica, Cesium.
Identifiers: *Everglades(Fla).

Baseline data on biomass production and elemental composition of plants from locations representative of Everglades saw-grass (Cladium jamaicense) ecosystems (burned and unburned), a wet prairie community, and a burned muck site of saw-grass were collected in the Everglades Wildlife Management Area, Florida. Chemical compositions (Nitrogen, phosphorus, potassium calcium, magnesium, sodium, copper, iron, manganese, zinc, cobalt, strontium, lead, nickel, chromium, aluminum, and silica) were determined in plant and soil digests. Saw-grass was predominant and contributed to biomass in all plots except in the wet prairie where Rhynchospora and Panicum hemitomon were the most common. Dead saw-grass biomass was greater than that of living plants in unburned saw-grass plots. In burned saw-grass, muck burn, and wet prairie, there were a large number of plant species but biomass production was less than in unburned saw-grass locations. Levels of copper, manganese, calcium, magnesium, potassium, and nitrogen varied in different locations. Significant differences in chemical composition were observed between plant species. Zinc, calcium, magnesium, phosphorus, and nitrogen concentrations were low in live saw-grass, compared to other species. Fallout cesium-137 levels ranged from 670 to 3100 picocuries/kg in sandy and organic soils, respectively. The Polygonum Cs-137 level was 11,600 picocuries/kg. Rapid Cs-137 leaching was observed from dead saw-grass. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10314

EFFECTS OF CLEAR-CUTTING ON NUTRIENT LOSSES IN ASPEN FORESTS ON THREE SOIL TYPES IN MICHIGAN,
Michigan Univ., Ann Arbor. School of Natural Resources.
For primary bibliographic entry see Field 4C.
W76-10315

MOBILIZATION OF NUTRIENTS IN SOIL BY ACIDS OF SULFUR AND CHELATING AGENTS,
California Univ., Los Angeles, Lab., of Nuclear Medicine and Radiation Biology.
For primary bibliographic entry see Field 5B.
W76-10316

EFFECTS OF TREE SPECIES, TEMPERATURE, AND SOIL ON TRANSFER OF MANGANESE-54 FROM LITTER TO ROOTS IN A MICROCOSM,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
M. Witkamp, and B. Ausmus.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 694-699. 1 fig., 1 tab., 10 ref. NSF AG-199, 40-193-69.

Descriptors: *Cycling nutrients, *Sorption, *Trees, *Manganese, *Soil microorganisms, Litter, Roots, Decomposing organic matter, Black locust trees, Loblolly pine trees, Limestones, Shales, Leaching, Movement, Percolation, Hydrogen ion concentration, Detritus, Model studies.

Litter, soil, and microbial effects on manganese-54 transfer from litter to roots were compared to two litter decomposability levels (black locust-rapid and loblolly pine-slow), two soils (dolomitic limestone and sandstone-shale), and microbial activity levels at 2C and 25C. Mn-54 leachability and mobility were high during the first week. Pine litter was greater and affected more by temperature. Litter species affected Mn-54 downward percolation and seedling uptake. Locust leachate was viscous, black, with a pH of 8.4 and high organic content. Adsorption to leached organics and microbial immobilization kept Mn-54 in the top layer. Pine needles showed no decomposition; leachate color was light and viscosity, bacterial content, soil infiltration by leachate, and microbial blooms low, suggesting little microbial immobilization in topsoil. Temperature effects were evident in pine leachate Mn-54 content; there was no microbial growth on pine needles at 2C. Temperature effects were reversed with locust litter and topsoil; at 25C decay mineralized more litter Mn-54 than was immobilized by microflora. Topsoil Mn-54 retention prevented it from reaching leachate. Litter species and microbial activity rates were dominating factors in Mn-54 recycling from detritus-plants. Soils types had no effect on transfer from litter-topsoil-bottom soil, but affected uptake by trees. Element transfer models should consider microbial action. (See also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10317

ASPECTS OF MINERAL-NUTRIENT CYCLING IN A SOUTHERN MIXED-HARDWOOD FOREST IN NORTH CENTRAL FLORIDA,
Florida Univ., Gainesville. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W76-10318

THE QUANTITY AND DISTRIBUTION OF FOUR NUTRIENT ELEMENTS IN HIGH-ELEVATION FOREST ECOSYSTEMS, BALSAM MOUNTAINS, NORTH CAROLINA,
Southern Illinois Univ., Carbondale, Dept. of Forestry.
For primary bibliographic entry see Field 5B.
W76-10319

SIGNIFICANCE OF BIOLOGICAL NITROGEN FIXATION AND DENITRIFICATION IN A DECIDUOUS FOREST ECOSYSTEM,
Georgia Univ., Athens. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W76-10320

MINERAL CYCLING STRATEGIES OF TWO DECIDUOUS AND TWO EVERGREEN TREE SPECIES ON A SOUTHERN APPALACHIAN WATERSHED,
Georgia Univ., Athens. Dept. of Botany.
F. P. Day, and D. T. McGinty.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 736-743. 3 tab, 10 ref. NSF AG 199,40-193-69.

Descriptors: *Cycling nutrients, *Hardwood, *Trees, North Carolina, Oak trees, Hemlock trees, Biomass, Primary productivity, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Bark, Leaves, Shrubs, Southeast US.
Identifiers: *Evergreen trees, Coweeta Hydrological Laboratory(NC), Dogwood, Rhododendron maximum.

The mineral-cycling strategies of two canopy species (one deciduous, Quercus prinus, and one evergreen, Tauga canadensis) and two subcanopy trees (one deciduous, Cornus florida, and one evergreen, Rhododendron maximum) at the Coweeta Hydrological Laboratory, North Carolina, were compared, based on biomass production and nutrient standing crops. Phosphorus, potassium, calcium, nitrogen, and magnesium were determined in the wood, bark, current twigs, and leaves of each species. The largest total nutrient standing crop was in Quercus because of its large biomass. The greatest proportion of leaf calcium and magnesium was in Rhododendron. Cornus was important in the annual nutrient cycle, because of its large number of nutrient-rich leaves. Quercus was important in the annual and in the long-term nutrient cycle. Rhododendron was important in an intermediate length cycle, because its turnover time is about seven years. In a mature forest, nutrients are stored in the vegetation and recycled at time intervals of a year to several hundred years, depending on the plant component. Depending on species growth habits, individual species may be more important in one or more phases of the cycling scheme. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10321

THE EFFECT OF NONREMOVAL CLEAR-CUTTING AND PINE REFORESTATION OF THE CATION COMPOSITION OF A HARDWOOD FOREST SOIL,
Environmental Protection Agency, Washington, D.C. Office of Environmental Sciences.
For primary bibliographic entry see Field 4C.
W76-10322

SOME EFFECTS OF FERTILIZATION ON MINERAL CYCLING IN LOBLOLLY PINE,
Southeastern Forest Experiment Station, Research Triangle Park, N.C. Forestry Sciences Lab.
C. G. Wells, A. L. Nicholas, and S. W. Buol.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 754-764. 5 tab, 7 ref. NSF AG 199,40-193-69.

Descriptors: *Fertilization, *Cycling nutrients, *Loblolly pine trees, Nitrogen, Phosphorus, Potassium, Litter, Throughfall, Soil water, Nitrates, Precipitation(Atmospheric), Southeast US, Forest soils, Leaching, Manganese, Sodium, Calcium, Magnesium, Zinc, Copper, Aluminum.

Effects of nitrogen, phosphorus, and potassium fertilization of a 14-year-old loblolly pine plantation on nutrients in litterfall and throughfall, on mineral accumulation in the forest floor, and on minerals in soil water were studied. Nitrogen, phosphorus, and potassium applied at rates of 226, 60, and 136 kg/ha as ammonium nitrate, triple superphosphate, and muriate of potash, respectively, were not immobilized in the forest floor. Some nitrate-nitrogen leached 120 cm into the soil to levels of 7 ppm at some points, but its concentra-

tion declined to about 0.5 ppm three years later. Nitrate-nitrogen loss below 120 cm was approximately balanced by precipitation input. The first year after fertilization increased mineral elements in litterfall and throughfall accounted for about 5% of nitrogen and 10% of potassium applied. The second year increased litterfall and increased concentrations in litterfall and throughfall amounted to 10% of the nitrogen plus phosphorus applied. Differences between fertilized and nonfertilized plots indicated that 25% of the applied nitrogen was in the forest floor two years after fertilization, but litterfall rather than immobilization of applied nitrogen appeared to be the major source of additional nitrogen. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10323

INFLUENCE OF NUTRIENT AVAILABILITY ON ECOSYSTEM STRUCTURE,
Mansfield State College, Pa. Dept. of Biology.
K. A. Meyer, J. F. McCormick, and C. G. Wells.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p 765-779. 2 fig, 3 tab, 31 ref. AEC AT(110-1)-3299.

Descriptors: *Granites, *Cycling nutrients, *Plant populations, Productivity, Biomass, Distribution patterns, Succession, Soil density, Limiting factors, Calcium, Magnesium, Potassium, Phosphorus, Nitrogen, Nitrates, Ammonia, Rainfall, Leaching, Organic matter, Hydrogen ion concentration, Cation exchange, Southeast US, Trace elements.
Identifiers: *Granite outcrops, Sedum smallii, Minuartia uniflora, Viguiera porteri, Herbaceous plants, Mt Arabia(Ga).

Ecosystem structure (production distributions, densities, and biomass) was analyzed in island ecosystems of annual perennial herb type plants on granite outcrop soils on Mt. Arabia, Georgia. Availability of nutrients (calcium, magnesium, potassium, phosphorus, nitrogen, nitrates, ammonia) in soil of each species habitat, including contributions from rain, groundflow, soil pools, soil organic matter mineralization, and leaching from dead vegetation was determined. Nutrient uptake was estimated for Sedum smallii, Minuartia uniflora, and Viguiera porteri. From comparisons of nutrient availability in different habitats with nutrient levels required by the dominant populations, an hypothesis is developed suggesting that species population distribution in outcrop ecosystems is influenced by nutrient availability and/or competition for available nutrients. The shallow sandy soils with a low pH were relatively infertile. Soil organic matter, cation-exchange capacity, and soil nutrients (except phosphorus) increased toward the ecosystem center. Comparisons of nutrient uptakes by each species with estimated annual nutrient availability showed the growth potential of each species in areas outside its natural occurrence. Soil nutrients became limiting to growth and distribution of the dominant plants, thus affecting the ecosystem structure. Calcium, magnesium, and nitrogen availability plus interspecific competition for these elements limited species growth and distribution when there was adequate moisture. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10324

NUTRIENT BUDGETS FOR UNDISTURBED ECOSYSTEMS ALONG AN ELEVATIONAL GRADIENT IN NEW MEXICO,
New Mexico Univ., Albuquerque. Dept. of Biology.
J. R. Gosz.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 780-799. 3 fig., 7 tab., 28 ref.

Descriptors: *Energy budget, *Cycling nutrients, *Ecosystems, *Biomes, New Mexico, Watersheds(Basins), Vegetation, Calcium, Sodium, Magnesium, Potassium, Confierous trees, Bedrock, Alpine, Precipitation, Mountains, Dusts, Slopes, Input-output analysis, Evapotranspiration, Primary productivity, Elevation, Juniper trees, Grasslands, Semiarid climates, Runoff.
Identifiers: Tesuque Watersheds(NM), Sangre de Cristo Mountains(NM), Santa Fe National Forest(NM), Aspen trees.

The Tesuque watersheds in the Sangre de Cristo Mountains of New Mexico were selected for ecosystem studies in which nutrient flux was determined in different vegetational zones and biomes along an elevational gradient on a common bedrock. Nutrient budgets for calcium, magnesium, sodium, and potassium were determined during 1972-1973 for watershed ecosystems with vegetation ranging from pinion-juniper to spruce-fir and alpine tundra. Nutrient inputs varied with elevation due to precipitation at high elevations and dust at low elevations. Seasonal quatity and distribution of precipitation affected relationships between nutrient inputs from dust and precipitation. Stream chemistry and nutrient output (dissolved loss) varied with elevation and involved evapotranspiration, nutrient uptake, throughfall, discharge volume, carbon dioxide production in soil, and soil chemistry. The nutrient budgets indicated that the smallest loss or greatest accumulation usually occurred on intermediate elevations which had a mixed conifer vegetation. This zone had the greatest plant and animal diversity. The high evapotranspiration rate of this zone suggested that it had the highest primary production rate. The results supported the hypothesis that a high efficiency of nutrient cycling (nutrient conservation) is associated with high productivity and community complexity. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10325

NUTRIENT RETURN IN THE STEMFLOW AND THROUGHFALL OF INDIVIDUAL TREES IN THE PIEDMONT DECIDUOUS FOREST,
Duke Univ., Durham, N. C. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W76-10326

NITROGEN FIXATION BY LICHENS OF THE NORTHERN PIEDMONT,
Wake Forest Univ., Winston-Salem, N. C.
J. C. Murphy, and V. E. Becker.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p. 824-832. 3 tab., 23 ref.

Descriptors: *Nitrogen fixation, *Lichens, *Cyanophyta, *Symbiosis, Light, Moisture, North Carolina, Forests, Varieties, Deciduous trees, Temperature.
Identifiers: Northern Piedmont(NC), Leptogium cyanescens, Leptogium corticola, Collema subfurvum, Collema conglomeratum, Sticta weigelii, Lobaria pulmonaria, Lobaria quercizans.

Nitrogen fixation by lichens containing blue-green algae phycobionts was determined with an acetylene-reduction method in presence of light and high moisture. Specimens collected in mature forests in the northern Piedmont, North Carolina, included lichen containing blue-green algae as primary phycobionts (Leptogium cyanescens, Leptogium corticola, Collema subfurvum, Collema conglomeratum, and Sticta weigelii) and lichens containing blue-green algae in cephalodia (Lobaria pulmonaria and Lobaria quercizans). Lichens with blue-green algae as primary phycobionts had higher nitrogen contents than Lobaria, perhaps due to a higher fixation rate. Collema conglomeratum had a lower nitrogen content, lower fixation rate, and was covered with apothecia. Most lichens with blue-green algae as their primary phycobiont fixed nitrogen more rapidly than lichens with algae incephalodia. Nitrogen contents/unit surface area were less variable than fixation data and were related to the thickness or lobe compactness. Lichens with many apothecia or blue-green algae in cephalodia had lower fixation rates/unit surface area. Fixation rates did not account for total thallus nitrogen replacement each year, but because of lichens' slow growth appeared to be adequate to account for thallus nitrogen. If the fixation rate is only equivalent to nitrogen in the thallus, reduced nitrogen will be added to the ecosystem when the lichen dies. (See also W76-10266) (Buchanan-Davidson--Wisconsin)
W76-10327

EFFECTS OF FOREST FIRES ON ATMOSPHERIC LOADS OF SOLUBLE NUTRIENTS,
Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology.
For primary bibliographic entry see Field 4C.
W76-10328

CATION FLUX IN HARDWOOD AND WHITE PINE WATERSHEDS,
Georgia Univ., Athens. Dept. of Botany.
For primary bibliographic entry see Field 5B.
W76-10329

NUTRIENT LOSSES IN PARTICULATE FORM AS WEIR POND SEDIMENTS FROM FOUR UNIT WATERSHEDS IN THE SOUTHERN APPALACHIANS,
Georgia Univ., Athens. Dept. of Botany.
C. D. Monk.
In: 'Mineral Cycling in Southeastern Ecosystems,' 1975, (CONF-740513), p, 862-867. 2 tab., 6 ref. NSF AG-199, BMS69-01147.

Descriptors: *Vegetation effects, *Nutrients, *Sediments, *Erosion rates, *Watersheds(Basins), Appalachian Mountain Region, North Carolina, Hardwood, Pine trees, Forest management, Clays, Sands, Silts, Organic matter, Nitrogen, Calcium, Magnesium, Potassium, Sodium, Phosphorus, Annual, Weirs.
Identifiers: Coweeta Hydrologic Laboratory(NC).

Weir-pond sediments were collected at three-month intervals for two years from four watersheds with contrasting vegetation in the Coweeta Hydrologic Laboratory, North Carolina. Annual sediment losses were 283 kg/ha from the coppice hardwoods, 176 from old field, 76 from pine plantation, and 30 from mature hardwood watersheds. Sediment losses followed seasonal trends, with greater losses normally observed in winter. Sediment composition from old field, coppice hardwood forests, and pine plantation watersheds were similar, averaging 77.4% sand, 13.6% silt, 9.0% clay, and 7.6% organic matter. The same values for the mature hardwood forest were 49.9, 17.6, 32.5, and 21.9%. The order of concentration from high to low was nitrogen, calcium, magnesium, potassium, sodium, and phosphorus. Calcium, magnesium, potassium, and phosphorus showed no seasonal trends. Concentrations were generally lower in the coppice forest sediments. Nitrogen and sodium changed seasonally with highest concentrations in winter. Nitrogen concentrations were higher in forest sediments; calcium and magnesium losses were higher from the pine plantation and hardwood forest; and calcium and magnesium levels were high in old field watershed sediments. Total annual nutrient losses were less than 1% of the total loss. (See also W76-10266) (Buchanan-Davidson--Wisconsin).
W76-10330

THE EFFECT OF URBAN LAND USE ON NUTRIENT AND SUSPENDED-SOLIDS EXPORT FROM NORTH FLORIDA WATERSHEDS,
Florida State Univ., Tallahassee. Dept. of Oceanography.
For primary bibliographic entry see Field 4C.
W76-10331

CHANGES IN SOME HEMATOLOGICAL CHARACTERISTICS OF COHO SALMON (ONCORHYNCHUS KISUTCH) IN RESPONSE TO ACUTE EXPOSURE TO DEHYDROABIETIC ACID (DHAA) AT DIFFERENT EXERCISE LEVELS,
British Columbia Univ., Vancouver. Dept. of Zoology.
G. K. Iwama, G. L. Greer, and P. A. Larkin.
Journal of the Fisheries Research Board of Canada, Vol. 33, p. 285-289, 1976. 2 tab., 20 ref.

Descriptors: *Pulp wastes, *Industrial wastes, Laboratory tests, *Toxicity, *Cytological studies, *Fish physiology, *Salmon, Biochemistry, Stress, Environmental effects, Water pollution effects, Salmonids, Methodology, Fish behavior, Mortality, Toxicants.
Identifiers: *Hematology, *Dehydroabietic acid(DHAA), Exercise levels(Fish), Oncorhynchus kisutch, Sublethal effects.

To determine if changes in some hematological parameters accompanied acute exposure of juvenile coho salmon (Oncorhynchus kisutch) to dehydroabietic acid (DHAA) at three different exercise levels, clotting times, hematocrits, erythrocyte sedimentation rates, red blood cell counts, and white blood cell counts were monitored over 6-, 12-, 24-, and 48-h exposure periods to 0.75 mg/liter DHAA. White cell counts decreased significantly after 24 h exposure and there was a significant increase in clotting times after 48 h exposure to DHAA. In both cases, differences between experimentals and controls were significant only at low and intermediate exercise levels, and not at a high exercise level. Hematocrits, erythrocyte sedimentation rates, and red blood cell counts were not significantly different between experimentals and controls for any of the exposure periods or exercise levels. (Katz)
W76-10333

A COMPARISON OF TRACE-METAL AND METALLOENZYME PROFILES IN DIFFERENT MOLLUSCS AND DURING DEVELOPMENT OF THE OYSTER,
Institute of Marine Biochemistry, Aberdeen(Scotland).
S. G. George, and T. L. Coombs.
In: Proceedings 9th European Marine Biology Symposium, p. 433-450, 1975. 11 fig., 3 tab., 24 ref.

Descriptors: *Enzymes, *Molluscs, *Immature growth stage, Manganese, Animal physiology, Biochemistry, *Trace elements, *Oysters, Zinc, *Mussels, *Absorption, Copper, Iron, Larval growth stage, Crustaceans, Invertebrates, *Metals, Metabolism, Water pollution effects, Methodology, Analytical techniques, Environmental effects.
Identifiers: Mytilus sp., Haliotis sp., Cardium sp.

The possibility of correlations between the trace-metal distribution and biochemical function in four species of molluscs from different habitats was investigated. Neither oyster larvae nor young spat were able to concentrate zinc; this ability developed between 50 and 100 days after settlement, and although it coincided with a general increase in zinc-metalloenzyme activity it could not be correlated with the ability to survive anaerobiosis because adult Mytilus does not contain high tissue zinc concentrations. The zinc-dependent digestive hydrolase enzymic activities are correlated with the dietary components. Malate dehydrogenase enzymic activity is very much greater than that of lactate dehydrogenase for the four species investigated. Lactate dehydrogenase activity is correlated with different muscular activity between species and during development of the oyster. Malate dehydrogenase activity is increased in oyster larvae when stored fat is metabolized. (Katz)
W76-10334

ACUTE TOXICITY OF SODIUM CHLORIDE, PENTACHLOROPHENOL, GUTHION(R), AND HEXAVALENT CHROMIUM TO FATHEAD MINNOWS (PIMEPHALES PROMELAS) AND GOLDFISH (CARASSIUS AURATUS),
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
I. R. Adelman, L. L. Smith, Jr., and G. D. Siesennop.
Journal of the Fisheries Research Board of Canada, Vol. 33, p. 203-208, 1976. 2 fig., 12 ref.

Descriptors: Resistance, *Pesticides, *Minnows, *Bioassay, *Chromium, *Toxicity, *Lethal limit, *Phenols, *Sodium chloride, *Industrial wastes, *Mortality, Toxicants, Laboratory tests, Water pollution sources, Methodology, Chlorinated hydrocarbon pesticides, Fish physiology.
Identifiers: Pimephales promelas, Carassius auratus, *Guthion(R), Pentachlorophenol, *Goldfish.

The 96-h LC50's for sodium chloride were 7650 and 7341 mg/liter, for pentachlorophenol 0.21 and 0.22 mg/liter, for Guthion(R) 1.9 and 2.4 mg/liter, and for hexavalent chromium 48 and 120 mg/liter, for fathead minnows (Pimephales promelas) and goldfish (Carassius auratus), respectively. Threshold LC50's were reached in 6 days for sodium chloride (7650 and 7322 mg/liter for fathead minnows and goldfish, respectively), and pentachlorophenol (0.21 and 0.21 mg/liter), but were not attained in 11 days (termination of testing) with Guthion(R) (0.76 and 0.80 mg/liter)and hexavalent chromium (18 and 33 mg/liter). With pentachlorophenol and Guthion(R) goldfish were initially more resistant, but by termination there was no significant difference in LC50's between the two specis. With hexavalent chromium the goldfish were more resistant throughout the 11-day test, and with sodium chloride goldfish were initially more resistant but at attainment of a threshold LC50 were less resistant. Use of toxicity curves for assessment of acute mortality permits interpretation not possible in 96-h tests where LC50's are computed at 24-h intervals. (Katz)
W76-10335

FATHEAD MINNOWS (PIMEPHALES PROMELAS) AND GOLDFISH (CARASSIUS AURATUS) AS STANDARD FISH IN BIOASSAYS AND THEIR REACTION TO POTENTIAL REFERENCE TOXICANTS,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries, and Wildlife.
For primary bibliographic entry see Field 5A.
W76-10336

THE EFFECT OF IN VIVO CHROMIUM EXPOSURE ON NA/K- AND MG-ATPASE ACTIVITY IN SEVERAL TISSUES OF THE RAINBOW TROUT (SALMO GAIRDNERI),
Cleveland Metropolitan General Hospital, Ohio. Dept. of Obstetrics and Gynecology.
R. M. Kuhnert, B. R. Kuhnert, and R. M. Stokes.
Bulletin of Environmental Contamination and Toxicology, Vol. 15, No. 4, p. 383-390, 1976. 2 tab., 1 fig., 19 ref.

Descriptors: *Enzymes, Biochemistry, Inhibitors, *Rainbow trout, Laboratory tests, *Chromium, *Bioassay, *Fish physiology, Metals, Water pollution effects, Environmental effects, Absorption, Analytical techniques, Methodology, Spectrophotometry.
Identifiers: *ATPase, Tissue analysis, Sublethal effects, Bioaccumulation.

The effect of in vivo chromium exposure on Na/K- and Mg-ATPase activity was studied in several tissues of the rainbow trout, Salmo gairdneri. Those tissues studied were: intestine, gill, liver, and kidney. Tissue chromium levels were determined for control rainbow trout and trout exposed to 2.5 mg Cr/l (as chromate) for 48 hours. After exposure to chromium, inhibition of Na/K-ATPase activity, but not Mg ATPase activity, was observed. These results may partially explain the detrimental effects of hexavalent chromium on fish. (Katz)
W76-10337

DELTA-AMINO LEVULINIC ACID DEHYDRATASE ACTIVITY IN FISH BLOOD AS AN INDICATOR OF A HARMFUL EXPOSURE TO LEAD,
Canada Centre for Inland Waters, Burlington (Ontario).
P. V. Hodson.
Journal of the Fisheries Research Board of Canada, Vol. 33, p. 268-271, 1976. 1 fig., 10 ref.

Descriptors: *Lead, *Enzymes, Biochemistry, Methodology, *Rainbow trout, *Inhibitors, Water quality control, *Bioindicators, Public health, Laboratory tests, *Pollutant identification, Water pollution effects, Heavy metals, Fish physiology, Analytical techniques.
Identifiers: *Sublethal effects.

The activity of red cell D-amino levulinic acid dehydratase of rainbow trout (Salmo gairdneri) was depressed after exposure of the fish to lead. Concentrations of lead in water as low as 13 micrograms/liter caused a significant inhibition of activity after only 4-wk exposure. Assays of this enzyme's activity may provide a short-term indication of long-term harmful effects of lead. (Katz)
W76-10338

EFFECTS OF POWER-PLANT COOLING SYSTEMS ON MARINE PHYTOPLANKTON,
California Univ., Irvine. Dept. of Environmental Biology.
F. J. P. Briand.
Marine Biology, Vol. 33, No. 2, p 135-146, 1975. 4 tab., 10 fig., 53 ref.

Descriptors: *Temperature, *Mortality, Power-plants, *Cooling water, *Diatoms, *Phytoplankton, *Dinoflagellates, *Heated water, Plant populations, Aquatic populations, *Primary productivity, Cooling, Marine microorganisms, Algae, Biological communities, Dominant organisms, Seasonal, Chlorination, *Thermal pollution, Water pollution effects.
Identifiers: *Species diversity.

The large quantities of marine phytoplankton passing through the cooling systems of two Southern California coastal power plants were found to be greatly reduced in numbers (41.7%) and in volume (33.7%). Phytoplankton mortalities were most pronounced from October to December when intake waters of 17 to 20 C were subjected to temperature elevations of 9 to 11 C, and were lowest from January to March when cooler ambient temperatures prevailed. There was no apparent reduction in phytoplankton stocks when the intake water was cooler than 15 C. Surviving cells in 25 and 26.5 C effluent waters grew three times faster than influent populations, which suggests the short-term effects of power-plants on phytoplankton. Entrainment effects are very disruptive to the structure of phytoplankton communities and in reducing species diversity. Passage through the condenser tubes affected algal species differentially, killing diatoms in greater numbers than dinoflagellates. On this basis, use of deep-sea water by coastal power plants for cooling is advocated. (Katz)
W76-10339

AROCLOR 1016: TOXICITY TO AND UPTAKE BY ESTUARINE ANIMALS,
Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab.
D. J. Hansen, P. R. Parrish, and J. Forester.
Environmental Research, Vol. 1, p. 363-373, 1974. 5 tab., 4 fig., 8 ref.

Descriptors: *Cytological studies, Pathology, *Mortality, Retention, *Aroclor, *Polychlorinated biphenyls, Oysters, Shrimp, *Bioassay, *Toxicity, *Lethal limit, *Absorption, *Brackish water fish, Pesticides, Benthic fauna, Invertebrates, Shellfish, Fish diseases, Laboratory tests, Water pollution effects, Path of pollutants, Pesticide residues, Microscopy, Chromatography.
Identifiers: Bioaccumulation, Lagodon sp., Sublethal effects, Penaeus sp., Palaemonetes sp., *Pinfish, *Tissue analysis, Brown shrimp.

Bioassays were conducted to determine the acute toxicities of the polychlorinated biphenyl (PCB) Aroclor 1016 in flowing sea water to American oysters (Crassostrea virginica), brown shrimp (Penaeus aztecus), grass shrimp (Palaemonetes pugio), and pinfish (Lagodon rhomboides), and to determine its toxicity to, and uptake and retention by pinfish. Acute 96-hr LC50's were: oysters, 10.2 micrograms/l; brown shrimp, 10.5 micrograms/l; grass shrimp, 12.5 micrograms/l. The PCB was not toxic to pinfish at 100 micrograms/l for 96-hr, but significant mortality occurred when pinfish were exposed to 32 microgram/l of Aroclor 1016 for 42 days. Pinfish exposed to 1 microgram/l for 56 days accumulated the chemical to 17,000 x the nominal concentration in test water. Pathologic tissue alterations occurred in pinfish exposed to 32 microgram/l of Aroclor 1016 for 42 days. (Katz)
W76-10340

ACUTE CADMIUM TOXICITY STUDIES UPON NINE SPECIES OF AQUATIC INSECTS,
Utah Univ., Salt Lake City. Dept. of Biology.
R. W. Clubb, A. R. Gaufin, and J. L. Lords.
Environmental Research, Vol. 9, p. 332-341, 1975. 4 fig., 9 tab., 11 ref.

Descriptors: *Stoneflies, *Mayflies, *Bioassay, *Aquatic insects, *Cadmium, *Absorption, *Lethal limit, *Mortality, *Toxicity, Insects, Laboratory tests, Invertebrates, Path of pollutants, Water quality control, Water pollution effects, Metals, Industrial wastes.
Identifiers: Bioaccumulation, Ephemerella sp., Pteronarcella sp.

Continuous-flow bioassays were employed to determine 96-hr median tolerance limits (TLm) for the stonefly, which had a TLm value of 18.0 mg Cd/l, and the mayfly, which had a TLm value of 28.0 mg Cd/l. Ninety-six hour TLM values for other species of aquatic insects tested were not determined since these species were relatively insensitive to cadmium. Insects exposed for four days to cadmium-containing water, then placed in clean water, show a linear rate of cadmium loss. This loss may lower or prevent mortality under ideal conditions. (Katz)
W76-10342

PIKES (ESOX LUCIUS L.) SHOWN TO BE AFFECTED BY LOW PH VALUES DURING FIRST WEEKS AFTER HATCHING,
Uppsala Univ., (Sweden). Inst. of Zoology.
N. Johansson, and J. E. Kihlstrom.
Environmental Research, Vol. 9, p. 12-17, 1975. 4 fig., 4 tab., 9 ref.

Descriptors: *Hydrogen ion concentration, *Mortality, *Juvenile growth stage, Fry, *Pikes, Movement, *Fish behavior, Fish physiology, Reproduction, Water quality, Environmental effects, Freshwater fish, Hatching, Fish reproduction.
Identifiers: Esox sp.

New hatched pike (Esox lucius) sac fry from artificially fertilized eggs were reared for eight days in water solutions with pH values ranging from 4.0 to 7.2. The mortality was 17% t pH 6.8, 26% at pH 5.0, and 97% at pH 4.2. Sac fry reared at pH 4.2 showed a less rapid development than those raised at pH 5.2 and 6.8, and showed a lesser degree of mobility. (Katz)
W76-10343

THE IDENTIFICATION OF PHTHALIC ACID ESTERS IN THE TISSUES OF CYPRINODONT FISH AND THEIR ACTIVITY AS HEARTRATE DEPRESSORS,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 5A.
W76-10344

SYNERGISM BETWEEN DISSOLVED OXYGEN AND CADMIUM TOXICITY IN FIVE SPECIES OF AQUATIC INSECTS,
Utah Univ., Salt Lake City. Dept. of Biology.
R. W. Clubb, A. R. Gaufin, and J. L. Lords.
Environmental Research, Vol. 9, p. 285-289, 1975. 1 fig., 3 tab., 18 ref.

Descriptors: *Bioassay, *Aquatic insects, *Cadmium, *Metabolism, *Absorption, *Dissolved oxygen, Insects, *Toxicity, *Mortality, Environmental effects, Diptera, Mayflies, Stoneflies, Caddisflies, Laboratory tests, Analytical techniques, Invertebrates, Toxicants, Metals, Oxygen.
Identifiers: *Synergistic effect(Insects).

Continuous-flow bioassays were employed to determine the relationship between dissolved oxygen and cadmium in five species of aquatic insects, as measured by survival and the amount of cadmium found within the insect. Results indicate the toxicity of cadmium increases as the dissolved oxygen concentration increases. This may be explained by an observed increase in the amount of cadmium found in the insect as the dissolved oxygen concentration increases. Oxygen consumption has been reported to increase as the dissolved oxygen concentration increases. In this study, using a fixed cadmium concentration, the amount of cadmium found in the insect also increaded with an increase in the dissolved oxygen. Therefore, cadmium absorption may be coupled to metabolism. (Katz)
W76-10345

THE INFLUENCE OF HARDNESS COMPONENTS (CA2+ AND MG2+) IN WATER ON THE UPTAKE AND CONCENTRATION OF CADMIUM IN A SIMULATED FRESHWATER ECOSYSTEM,
Northeast Louisiana Univ., Monroe. Dept. of Biology.
M. L. Kinkade, and H. E. Erdman.
Environmental Research, Vol. 10, p. 308-313, 1975. 2 fig., 1 tab., 5 ref.

Descriptors: *Hardness(Water), *Cadmium, *Calcium, *Magnesium, Ecosystems, *Cadmium radioisotipes, *Tracers, *Algae, *Catfish, Aquatic plants, *Snails, *Absorption, Environment effects, Laboratory tests, Water quality, Chemical properties, Analytical techniques, Freshwater fish, Pollutant identification.
Identifiers: Bioaccumulation, *Elodea.

Members of a simulated freshwater ecosystem, an alga, a rooted plant, infusoria snails, catfish and guppies were cultured together for 1 to 12 hours and from 1 to 21 days in hard water (total Ca2+ and Mg2+ approximately 150 ppm) or soft water (total Ca2+ and Mg2+ 0 ppm) containing one initial concentration of 0.1 ppm Cd-115. At the end of each of the 10 different exposure periods, specimens of each species were evaluated for cadmium content. The amount of radioactivity indicated that the initial rate of Cd uptake by the organisms was faster in hard water than in soft water. However, the total concentration of Cd was greater in those organisms cultured in soft water than those in hard water. (Katz)
W76-10346

INCORPORATION OF 203HG INTO METHYLMERCURY IN FISH LIVER: STUDIES IN BIOCHEMICAL MECHANISMS IN VITRO,
Wisconsin Univ., Madison. Dept. of Entomology.
F. Matsumura, Y. Gotoh Doherty, K. Furukawa, and G. M. Boush.
Environmental Research, Vol. 10, p. 224-235, 1975. 2 fig., 7 tab., 12 ref.

Descriptors: *Mercury, Biochemistry, *Fish physiology, *Inhibitors, *Tracers, Laboratory tests, Heat, *Irradiation, Metals, Path of pollutants, Metabolism, Salmon, Methodology, Analytical techniques.
Identifiers: *Methylmercury, *Tune, Methylation, Livers.

Livers of all fish species studied, particularly pelagic species, were capabe of transforming mercuric ion into methylmercury in vitro. The factors involved in the process of methylmercury formation from Hg2+ ion in the fish liver were studied. The methylation activities wer not destroyed by either heat or ultraviolet and visible light irradiation treatments. It was thus concluded that the reaction(s) studied here was not mediated by methylcobalmine. Mersalyl, an SH inhibitor, could, however, abolish most of the methylation reaction. (Katz)
W76-10347

TOXICITY OF POLYDIMETHYLSILOXANES IN CERTAIN ENVIRONMENTAL SYSTEMS,
Dow Corning Corp., Midland, Mich.
E. J. Hobbs, M. L. Keplinger, and J. C. Calandra.
Environmental Research, No. 10, p. 397-405, 1975. 3 tab., 14 ref.

Descriptors: *Reproduction, *Degradation(Decomposition), *Biodegradation, *Adsorption, *Industrial wastes, *Toxicity, *Absorption, *Carbon radioisotopes, Tracers, *Bioassay, *Lethal limit, *Rainbow trout, *Sunfishes, Water pollution sources, Water pollution effects, Methodology, Analytical techniques, Laboratory tests, Daphnia, Freshwater fish, Marine fish, Mortality, Mallard duck, Poultry.
Identifiers: *Polydimethylsiloxanes, *Silicones.

Selected polydimethylsiloxane (PDMS) fluids and formulations were studied in certain biological systems to evaluate the possible environmental impact of these materials. These siloxanes are not detectably degraded by sewage microorganisms as shown in a study with marked PDMS. The very low toxicity of these materials to daphnia, freshwater fish, marine species, mallard ducks, bobwhite quail and domestic chicken, and their non-accumulation in the flesh and eggs of chickens and in the flesh of fish minimizes concern regarding their potential to cause environmental damage. (Katz)
W76-10348

STANDARDIZATION OF THE CONTENT OF BENZO(A)-PYRENE IN WATER BODIES, (IN RUSSIAN),
Kiev Research Inst. of General Communal Hygiene (USSR).
N. Ya. Yanysheva, Ya. I. Kostovetskii, and Z. P. Fedorenko.
Gig Sanit. 7, p 71-75, 1974.

Descriptors: *Organic compounds, Standards, Water pollution effects, Diseases.
Identifiers: *Carcinogens, Tumors, *Benzopyrene.

For standardizing the content of benzo(a)pyrene in water bodies, data on the blastomatogenic activity of various doses of this carcinogen following its oral introduction into the gastrointestinal tract of mice were obtained. A graph of the dependence of the frequency of stomach tumors on dose of the carcinogen was plotted. The maximum allowable concentration of benzo(a)pyrene in water bodies was determined by an equation taking into account the ratio of animal and human body weight, safety factor, and volume of water consumed by a person during his life. The maximum allowable concentra-

tion of benzo(a)pyrene in water bodies should not exceed 0.0004 micro-g/l.--Copyright 1975, Biological Abstracts, Inc.
W76-10351

A DISCUSSION OF THE EFFECTS OF CERTAIN POTENTIAL TOXICANTS ON FISH AND SHELLFISH IN THE UPPER DELAWARE ESTUARY,
Delaware Univ., Newark.
A. Scheier, and P. Kiry.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-231 423, $4.50 in paper copy, $2.25 in microfiche. Academy of Natural Sciences of Philadelphia, Penn., December, 1973, 50 p, 7 tab., 1 fig.

Descriptors: Delaware, *Delaware river, *Estuaries, *Estuarine environment, *Toxicity, *Metals, Shellfish, Estuarine fisheries, Brackish water fish, Aquatic habitat, Water pollution effects, Marine fish, Freshwater fish, Environmental effects, Zinc, Iron, Nickel, Magnesium, Cadmium, Copper, Chromium, Manganese, Lead, Aluminum, Mercury.
Identifiers: *Delaware River Estuary System, Upper Delaware Estuary.

The purpose is to set forth the potential toxicants in the Upper Delaware Estuary and to determine whether their concentrations are sufficient to contribute to the reduction of fish and shellfish species in the Upper Estuary. A list of species historically found in the Upper Delaware Estuary serves as a baseline for comparison with species lists recently compiled during surveys of the Upper Estuary. A summary of the maximum concentrations of metals found in the Upper Estuary is presented, along with recommended safe concentrations. Of the ten potentially toxic substances listed, at least nine occur in sufficient quantity to contribute to lethal effects. Many of these ions occur fairly equally throughout the Upper Estuary, but the highest concentrations are, in general, found in the most industrialized and urbanized areas of the Upper Estuary. Investigation of available data concerning the effects of potential toxic ions upon fish and shellfish in the Upper Estuary leads to the conclusion: much more information must be generated before intelligent and rational policies for the future use of the Upper Estuary can be formulated. (Katz)
W76-10352

PROCEEDINGS OF THE CONFERENCE ON MARINE BIOLOGY IN ENVIRONMENTAL PROTECTION HELD AT SAN CLEMENTE ISLAND, CALIFORNIA ON 13-15 NOVEMBER, 1973.
Naval Undersea Center, San Diego, Calif.
Available from the National Technical Information Service, Springfield, Va 22161 as AD/A-004 606, $7.50 in paper copy, $2.25 in microfiche. Report NUC TP 443, Published December, 1974, 187 p.

Descriptors: *Marine biology, *Environmental control, *Environmental engineering, *Enzymes, Bioassay, Toxicity, Marine algae, Annelids, Mollusks, Fish physiology, Water analysis, Fish diseases, Statistical methods, Fouling, Aquatic algae, California, *Sea water, Pollutant identification, Water pollution effects, Path of pollutants.
Identifiers: Southern California.

Short presentations were made on the following topics: the fouling community as a field monitoring technique; problems and techniques of marine biology in the field; systematic analysis of field survey techniques; the systems concept and pollution control; and the need for more intercomparable field data and widely applicable, short-term survey techniques. Papers were presented on the following topics: biological consideration of a bioassay system; a reliable algal assay procedure based on pH measurements; the sublethal effects of pollutants on polychaetous annelids; byssal thread production as a toxicity test; the activities of enzymes as pollution indicators; chemical problems encountered in toxicity studies; antifouling coatings and their influence on the marine environment; disease responses in southern California coastal fishes; and comparison of marine toxicity tests. (See W76-10354 thru W76-10367) (Katz)
W76-10353

THE FOULING COMMUNITY AS A FIELD MONITORING TECHNIQUE,
Naval Ship Research and Development Center, Annapolis, Md.
E. C. Fischer.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, on 13-15 November, 1973. December, 1974. p 7-17.

Descriptors: *Fouling, *Aquatic algae, *Aquatic plants, *Periphyton, Water pollution effects, Marine biology, Monitoring, Data collections, On-the-site investigations, Water quality, *Pollutant identification.
Identifiers: *Fouling racks, *Fouling plates.

Environmental biologists need an accurate, sensitive and economical technique for evaluating water quality over a period of time. The fouling community may contain valuable information which reflects ambient water quality. The use of fouling accretion panels placed in areas of heavy Navy activity is proposed as a standard field technique for environmental quality measurement by Navy laboratories. (See also W76-10353) (Katz)
W76-10354

PROBLEMS AND TECHNIQUES OF MARINE BIOLOGY IN THE FIELD: MODELING THE MARINE ECOSYSTEM,
California Univ., Davis. Dept. of Civil Engineering.
G. T. Orlob.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California on 13-15 November, 1973, December, 1974, p. 19-30, 1 tab, 1 fig, 15 ref.

Descriptors: *Marine biology, *Estuarine environment, Methodology, *Model studies, *Simulation analysis, *Mathematical models, Ecosystems, Bays, *Monitoring, Marine sediments, Water quality, California.
Identifiers: *Sediment modeling, San Diego outfall(Calif).

The art of mathematical modeling of aquatic systems has advanced rapidly during the past several years to the point where it is now being usefully applied in comprehensive studies of the marine environment. Investigations of circulation, sediment transport, heat exchange, water quality, and even marine ecosystems, are now facilitated through the use of models. Examples of current interest include studies of San Francisco Bay, Monterey Bay, the ocean outfall near San Diego, Puget Sound, and the New York Bight. In each of these studies, except that of the San Diego outfall, mathematical models have figured prominently as tools for environmental impact assessment and decision making. The San Diego case is of special interest because of the elaborate program set up by the San Diego Water Quality Control Board to monitor the impact of waste discharge on the marine environment, including marine benthic organisms in the region of the outfall. (See also W76-10353) (Katz)
W76-10355

SYSTEMATIC ANALYSIS OF FIELD SURVEY TECHNIQUES AND OPERATIONAL UTILITY OF ENVIRONMENTAL RESEARCH TO THE NAVY,
David W. Taylor Naval Ship Research and Development Center, Bethesda, Md.
For primary bibliographic entry see Field 5G.
W76-10356

THE SYSTEMS CONCEPT AND POLLUTION CONTROL,
San Diego State Univ., Calif.
For primary bibliographic entry see Field 5G.
W76-10357

THE NEED FOR MORE INTERCOMPARABLE FIELD DATA AND WIDELY APPLICABLE SHORT-TERM SURVEY,
Naval Undersea Center, Kailua, Hawaii. Hawaii Lab.
For primary bibliographic entry see Field 5G.
W76-10358

BIOLOGICAL CONSIDERATION OF A BIOASSAY SYSTEM,
Naval Ship Research and Development Center, Annapolis, Md.
G. L. Liberatore.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California, on 13-15 November, 1973, December, 1974, p 59-70, 6 tab, 7 ref.

Descriptors: *Bioassay, *Toxicity, Fish, Molluscs, Algae, Bacteria, Crustaceans, *Laboratory animals, Cadmium, *Marine animals, Methodology, Metals, Water analysis, Chesapeake Bay, Pollutant identification.
Identifiers: *Descaling agents, *Antifouling agents.

Seven different organisms, mostly indigenous to Chesapeake Bay, have been chosen to determine the LC50 (lethal concentration, 50 percent) with various chemicals. The bioassay system is a closed, one chemical dump or spill situation. Descaling, antifouling agents, and some metals have been used. The procedures have been constantly reviewed and revised with the aim that they should; (a) yield more statistical data, (b) reduce the time and workload, (c) approach the loading capacity of the system and (d) reflect the nature and life style of the organisms. None of the descaling agents were toxic, while the proposed antifouling agents ranged in toxicity from 1 ppm for fish to 50+ ppm for the oyster. The barnacle was the most sensitive to cadmium, while the fish was the least. The text of this presentation is divided into two phases: (a) brief description of the bioassay system in our laboratory at Annapolis and (b) some biological considerations of this system. (See also W76-10353) (Katz)
W76-10359

A RELIABLE ALGAL ASSAY PROCEDURE BASED ON PH MEASUREMENTS,
Naval Research Lab., Washington, D.C.
For primary bibliographic entry see Field 5A.
W76-10360

BYSSAL THREAD PRODUCTION AS A TOXICITY TEST,
Naval Undersea Center, San Diego, Calif.
For primary bibliographic entry see Field 5A.
W76-10362

THE ACTIVITIES OF ENZYMES AS POLLUTION INDICATORS,
San Diego State Univ., Calif.
For primary bibliographic entry see Field 5A.
W76-10363

CHEMICAL PROBLEMS ENCOUNTERED IN TOXICITY STUDIES,
Naval Ship Research and Development Center, Annapolis, Md.
For primary bibliographic entry see Field 5B.
W76-10364

ANTIFOULING COATINGS AND THEIR INFLUENCE ON THE MARINE ENVIRONMENT,
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 5G.
W76-10365

DISEASE RESPONSES IN SOUTHERN CALIFORNIA COASTAL FISHES,
Southern California Coastal Water Research Project, El Segundo.
M. J. Sherwood, and A. J. Mearns.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California, on 13-15 November, 1973, December, 1974, p. 147-162, 3 tab, 8 fig., 4 ref.

Descriptors: *Marine fish, *Water pollution effts, Pathology, *Toxicity, *Marine fisheries, *California, *Fish diseases, Waste water disposal, Parasitism, Effluents, Sewage effluents, Sea water, Bays.
Identifiers: *Fin erosion, Dover sole, Microstomus pacificus, Tuna, Santa Monica Bay(Calif), San Pedro Bay(Calif), Los Angeles(Calif).

The nearshore demersal fish communities of southern California have been extensively monitored by public and private agencies since 1969. The Southern California Coastal Water Research Project has assembled and analyzed much of the data in order to evaluate the health of local populations. One approach has been to investigate the frequency of diseased or anomalous specimens. Diseases with external symptoms may be easily observed and quantified in the field, and the presence of diseased individuals in a given habitat may be indicative not only of the health of the population but also of an imbalance in the community. A number of disease conditions were recorded during the trawl surveys. Of these, only fin erosion in the Dover sole (Microstomus pacificus) appeared to be directly related to wastewater discharge sites. At present, there are no direct links between the identifiable field effect and the suspected causes. A laboratory program has been designed to determine the role of microorganisms and physical/chemical factors in the disease response. (See also W76-10353) (Katz)
W76-10366

COMPARISON OF TOXICITY TESTS,
Naval Undersea Center, San Diego, Calif.
P. R. Kenis.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California, on 13-15 November, 1973, December, 1974, p. 163-180, 3 tab., 52 ref.

Descriptors: *Toxicity, *Bioassay, *Water pollution effects, Water quality standards, *Monitoring, Standards, Laboratory animals, Data collections, Measurement, Variability, Domestic wastes, Industrial wastes, *Bioindicators, Statistical analysis, Marine organism, Pollutant identification.
Identifiers: Acceptable concentration limits, Acute response, Chronic response, Maximum Acceptable Toxic Concentration(MATC), Application factor, TLm, Comparison of toxicity data.

The assessment of water quality using living organisms is an integral part of most water quality monitoring programs. Toxicity test data provide a basis from which to control discharged waste in receiving waters and to predi pct the impact evoked by the discharge. Toxicity tests are performed on chemicals or particulate matter known to be in waste effluents. This information can be used to establish acceptable concentration limits for the various pollutants and develop water quality standards. (See also W76-10353) (Katz)
W76-10367

CHANGES IN THE LEVELS OF ENVIRONMENTAL POLLUTANTS (HG, DDT, DIELDRIN, PCB) IN SOME SWEDISH FOODS,
National Swedish Food Administration, Stockholm. Food Lab.
G. Westoo.
Ambio, Vol. 3, No. 2, p. 79-83, 1974. 2 tab., 8 fig., 16 ref.

Descriptors: *Pesticide residues, *Public health, *Dieldrin, *Industrial wastes, *Mercury, *Foods, *DDT, *Polychlorinated biphenyls, Fish, Legislation, Pulp wastes, Chlorinated hydrocarbon pesticides, Path of pollutants, Pollutants, Toxicants, Food webs, Food chains, DDE, Distribution, Water pollution effects.
Identifiers: *Sweden.

Regulations have been issued by Swedish authorities in order to diminish the use of certain pesticides and other toxic compounds found as pollutants in the environment. The effects of the measures can be observed as decreasing levels of pollutants in certain foods. Mercury levels in Swedish foods of animal origin such as meats, eggs and liver decreased to roughly 1/3-1/6 early levels. Mercury levels in fish have also decreased in areas downstream from several wood pulp and paper pulp industries, but no decrease has been observed in the vicinity of chlorine-alkali industries. DDT in human milk has also decreased, but levels of PCB seem to have increased in the past few years. (Katz)
W76-10368

LOW THERMAL RESPONSIVENESS IN THE BLUEGILL, LEPOMIS MACROCHIRUS,
Wisconsin Univ., Madison. Lab. of Limnology.
T. L. Beitinger, and J. J. Magnuson.
Journal of the Fisheries Research Board of Canada, Vol. 33, p. 293-295, 1976. 7 ref.

Descriptors: *Sunfishes, Temperature, *Fish behavior, *Mortality, *Heated water, *Water temperature, Freshwater fish, Laboratory tests, Thermal water, Seasonal, Lethal limit, Aquatic environment, Environmental effects, Diurnal, *Thermal pollution, Water pollution effects.
Identifiers: Lepomis machrochirus, Thermal responsiveness, Acclimation.

Fifteen young bluegill, Lepomis macrochirus, acclimated to 5C for at least 1 mo, died during temperature preference testing owing to apparent voluntary exposure to high temperatures. The mortality rate of 100% for these fish greatly exceeded the 3.8% rate found for 262 bluegill acclimated to temperatures ranging from 20 to 34C, and tested in the same apparatus. Modifications in the experimental design whereby fish acclimated to 5C were held at about 19C for 24 h during testing, enabled all fish to survive. These bluegill selected temperatures only 2C lower than those acclimated to summer conditions. (Katz)
W76-10369

MARINE POLLUTION MONITORING (PETROLEUM). PROCEEDINGS OF A SYMPOSIUM AND WORKSHOP,
National Oceanographic and Atmospheric Administration, Rockville, Md.
For primary bibliographic entry see Field 5B.
W76-10370

HYDROCARBONS IN BLUE MUSSELS FROM THE KIEL BIGHT,
Kiel Univ. (West Germany). Institut fuer Meereskunde.
For primary bibliographic entry see Field 5B.
W76-10408

DISTRIBUTION OF TAR BALLS AND NEUSTON SAMPLING IN THE GULF STREAM SYSTEM,
National Marine Fisheries Service, Narragansett, R. I. Narragansett Lab.
For primary bibliographic entry see Field 5B.
W76-10410

EFFECTS OF OILS ON BALTIC LITTORAL COMMUNITY, AS STUDIED IN AN OUTDOOR MODEL TEST SYSTEM,
Swedish Water and Air Pollution Research Lab., Studsvik (Sweden). Baltic Lab.
M. Notini, and A. Hagstrom.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974, p. 251-254, 5 fig, 1 tab, 9 ref.

Descriptors: *Oil pollution, *Laboratory tests, Methodology, *Marine algae, *Toxicity, *Model studies, Beaches, Intertidal areas, Gammarus, Oil spill, Bioassay, Crustaceans, Water pollution effects.
Identifiers: Littoral zone, Baltic, Fucus, Gammarus, Baltic zone, Littoral community, Sweden, Attenuity indices, Sweden.

An outdoor model system, simulating realistic littoral conditions was constructed to study oil pollution. A method was developed of using changes in the structures of Fucus communities which was both rapid and sensitive in measuring the effects of oil pollution. (See also W76-10370) (Katz)
W76-10411

EFFECT OF AN OIL SPILL ON BENTHIC ANIMALS IN THE LOWER YORK RIVER, VIRGINIA,
Virginia Inst. of Marine Sciences, Gloucester Point. Div. of Environmental Science and Engineering.
M. E. Bender, J. L. Hyland, and T. K. Duncan.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974. p. 257-259, 1 tab., 4 fig., 9 ref.

Descriptors: *Oil pollution, *Oil spills, *Toxicity, *Bioassay, Laboratory studies, On-the-site investigations, On-site tests, Benthic organisms, Intertidal areas, Estuaries, Invertebrates, Benthic communities, Water pollution effects, Methodology, *Statistical analysis, *Virginia.
Identifiers: *York River(Va), Cracking residue, No. 2 fuel oil, Species, Richness, Faunal similarities, Diversity indices, Acute toxicity.

The study documents both from field survey data and laboratory bioassay studies the effect of an accidental oil spill on the intertidal benthic communities of the Lower York River, Virginia. Species richness and faunal similarity appeared to give a better indication of the effects of the oil than did the informational diversity calculations. (See also W76-10370) (Katz)
W76-10412

MARINE POLLUTION BY CARCINOGENIC HYDROCARBONS,
Center for Science in the Public Interest, Washington, D. C.
J. B. Sullivan.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum), Proceedings of a Symposium and Workshop, December, 1974. p. 261-263, 18 ref.

Descriptors: *Oil pollution, *Toxicity, Pathology, *Organic compounds, *Marine animals, *Sea water, *Public health, *Safety, Chemical analyses, Marine fish, Mollusus, Crustaceans, Water pollution effects, Monitoring.
Identifiers: Polycyclic aromatic hydrocarbons, Tissue analysis, Carcinogenesis, Contaminated seafood.

Polycyclic aromatic hydrocarbons (PAH) contamination of seafood due to ocean oil pollution has received very little attention. It is clear, however, that relying on oily taste in seafood as a danger warning is not warranted by the studies indicated in this issue. (See also W76-10370) (Katz)
W76-10413

OHIO RIVER COOLING WATER STUDY,
Argonne National Lab., Ill.
B. P. Butz, A. Policastro, J. J. Reisa, Jr., D. R. Schregardus, and B. A. Lewis.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-235 227, $10.75 in paper copy, $2.25 in microfiche. Report EPA-905/9-74-004, June, 1974, 385 p., 36 tab., 102 fig.

Descriptors: *Aquatic biology, *Cooling water, *Ohio River, *Heated water, *Water pollution effects, *Thermal pollution, *Analytical techniques, Water pollution sources, Hydrothermal studies, Thermal power, Water temperature, Thermal stress, Biological effects, Hydrologic modeling, Freshwater fish.
Identifiers: Thermal regime, Thermal plume analysis, Thermal models, COLHEAT, STREAM, Edinger-Geyer, Temperature prediction, Model evaluation, Plume physics, Boundary effects.

This study presents a review and critique of existing technical information relevant to the environmental effects of the use of the Ohio River main stem for cooling. In order to evaluate the effect of heat discharges on the indigenous aquatic life of the Ohio River, an extensive review and critique of past and existing studies dealing with the biological aspects of cooling water was undertaken. In order to judge the effect of heat discharges on the thermal regime of the river, three one-dimensional river temperature prediction models - COLHEAT, STREAM and Edinger-Geyer were evaluated, and the most appropriate model was selected to analyze changes in temperature distribution along the river. The effects of heat discharges on the thermal regime of the river near the points of discharge were evaluated by analyzing and critiquing available thermal plume study results. (Katz)
W76-10414

MACROZOOBENTHOS OF WATER BODIES OF THE KHAZARASP REGION OF THE KHOREZM OBLAST, (IN RUSSIAN),
For primary bibliographic entry see Field 2H.
W76-10476

EXCHANGE FLOW BETWEEN LAKE ONTARIO AND HAMILTON HARBOUR,
Canada Centre for Inland Waters,Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W76-10496

5D. Waste Treatment Processes

OPERATION AND IMPACT OF NPDES IN REGION II, PART I,
Environmental Protection Agency, New York. Caribbean Construction Grants Branch.
For primary bibliographic entry see Field 5G.
W76-10005

RETENTION OF METALS IN SEWAGE SLUDGE II: INCORPORATED RADIOISOTOPES,
Agricultural Research Service, Beltsville, Md. Agricultural Environmental Quality Inst.
For primary bibliographic entry see Field 5A.
W76-10006

FLOATING STRUCTURAL PLASTIC TRUSS SYSTEM PROTECTS WASTE LAGOON LINING,
FMC Corp., San Jose, Calif.
For primary bibliographic entry see Field 5G.
W76-10007

MUDS, SLIMES AND SLUDGES,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Mineral Chemistry.
R. Arnold.
Proceedings of the Royal Australian Chemical Institute, Vol. 43, No. 2, p 51-53, February, 1976. 1 fig, 11ref.

Descriptors: *Sludge analysis, *Sludge treatment, *Sewage sludge, Organic compounds, Suspended solids, Waste disposal, Filtration, Sedimentation, *Waste water treatment.

Waste discharges of finely divided solids suspended in water are usually treated by coagulation and settling, but not all suspensions settle out readily. Although inorganic slurries sometimes cause problems, orgaic sludges, such as those produced from sewage, textile processing, or the food industry, are always difficult to dewater. These pose a serious problem since they usually are produced in populous areas. However, quantities of these sludges are much smaller than those of inorganic sludges from mining. Due to the smaller quantities, sedimentation can be supplemented with filtration and other more costly processes. Organic sludges' main components are crosslinked natural hydrophilic polymers, such as proteins or carbohydrates. Probably stabilization is due largely to a sort of inbuilt 'stearic stabilization', and charge has a less important role. The only practical way of inducing this kind of colloid to settle is some type of flocculation. Most of the troublesome sluges are already flocculated, but the sediment is a more or less structured gel retaining a large amount of water. Mechanically breaking the structure enables more water to be removed from the sediment. The sediments are usually compressible, and higher solids contents will result under loading from deep beds. This loading effect also benefits filtration. (Snyder-FIRL)
W76-10008

A METHOD FOR ASSESSING FRICTION LOSSES FOR A NON-NEWTONIAN FLUID, SUCH AS SEWAGE SLUDGE, UNDER LAMINAR FLOW CONDITIONS,
Thames Water Authority, London (England) Metropolitan Public Health Div.
For primary bibliographic entry see Field 5B.
W76-10009

USE OF HIGH LEVEL RADIATION IN WASTE TREATMENT--STATUS AND PROSPECTS,
International Atomic Energy Agency, Vienna (Austria). Div. of Life Sciences.
S. Kobayashi.
Atomic Energy Review, Vol. 13, No. 3, p 615-621, September, 1975.

Descriptors: *Sewage treatment, *Waste water treatment, *Irradiation, Cost-benefit analysis, Pilot plants, Waste treatment, Cost analysis.
Identifiers: *Ionizing radiation.

A symposium was held in March, 1975, on the application of high level radiation to waste treatment. Discussion included treatment and reuse of waste water, radiosensitivity of microorganisms, disinfection and microbiological control, chemical and physical modification of aqueous pollutants, economic and technological considerations, pilot-plant design and operating experience, and radiation treatment of non-liquid wastes. Ionizing radiation, possibly combined with other treatment methods, is useful in solving problems of waste treatment and reuse of spent resources. Several methods of increasing the cost-effectiveness of microbiological control are discussed. While the use of ionizing radiation to decompose aqueous pollutants has advantages, its yield is generally too low to compete successfully with other methods. There is still disagreement about the choice of radiation source, and cost-benefit considerations are still unclear. Several pilot plants using radiation treatment are already operating, and it is expected that commercial plants will soon be built. Recommendations included study of the surface properties of suspended sewage particles and their reaction with radiolytic species, reporting of end products and pollutional effects when pollutants are treated by radiation, further study of the natural resistance of microorganisms to radiation, and an experimental protocol for study of radiation treatment of sludge and waste water. (Snyder-FIRL)
W76-10010

CHLORINE LOOKS SECURE AS WATER REAGENT.
Canadian Chemical Processing, Vol. 60, No. 3, p 28-29, March, 1976.

Descriptors: *Chlorine, *Disinfection, *Toxicity, Aeration, Lagoons, Pilot plants, Gamma rays, *Waste water treatment, Chlorination, Costs.
Identifiers: Dechlorination.

Unwanted contaminants may be introduced into the environment by water disinfection with chlorine. Water chemists suspect that some of the chloro-compounds that persist in nature are generated during water disinfection. Industry and agriculture do not account for all the chloro materials released to the environment. Primary effluent is usually toxic to fish; unchlorinated secondary effluent is nontoxic; and either stream containing 0.1 mg/liter residual chlorine is toxic for several hr, depending on water aeration. The chlorine residual is soon lowered to below the toxic threshold, 0.02 mg/liter, by lagooning/aeration. Use of a reducing agent, such as sulfur dioxide, to treat the chlorinated water also neutralizes the residual chlorine. When chlorine is added to effluent, it reacts to form several compounds including chloramines, which reduce coliform bacteria counts and are toxic to fish. Treatment with sulfur dioxide decomposes the chloramines and renders the water nontoxic. Chlorination costs about 7 cents/Imperial gal, and dechlorination would add another cent/1000 Imperial gal. A pilot unit disinfecting waste water with gamma rays was compared with a chlorination unit of similar size. The gamma irradiator performed well and had no 'gross interaction with the waste water' other than its biocidal action. Costs for gamma radiation to produce disinfection similar to that produced by chlorine have been estimated at 64 cents/1000 gal. Gamma radiation will probably not be used to treat waste water unless this cost is drastically reduced. (Snyder-FIRL)
W76-10011

BENEFICIAL EFFECTS OF BAKING SODA ADDED TO SEPTIC TANKS,
Septic Tank Systems, Berkeley, Calif.
J. H. T. Winneberger, and M. S. Weinberg.
Journal of Environmental Health, Vol. 38, No. 5, p 322-326, March-April, 1976. 2 fig, 2 tab, 12 ref.

Descriptors: *Septic tanks, *Chemical precipitation, *Suspended solids, *Domestic wastes, *Waste water treatment, *Flocculation, Sodium compounds.
Identifiers: *Baking soda additives.

Additives for septic tanks are discussed. Septic tanks are not generally designed for efficient operation, but dead zones could provide for gradual release of chemical additives. Experiments with fresh water in salt-water filled models showed that intermittent addition could be effec-

tive. Chemicals were also added to the water entering two actual septic tanks of different sizes; one had been cleaned recently. Their liquid volumes had considerablr hydraulically less active zones which could store suspended or dissolved additives and exchange them slowly with active zones. Cationic flocculants increase flocculation, but in excessive amounts, can increase suspended solids. Experiments adding varied amounts of flocculant to raw sewage showed that an optimum amount of flocculant exists at which maximum removals of suspended solids occur. Due to their rather narrow effectiveness range, cationic polymers could cause problems as septic tank additives, due to varying septic tank sizes and the tendency of some homeowners to add more than the recommended quantities. Baking soda is being added to septic tanks as a result of its use to deodorize drains. One study found that the addition of baking soda improved floccu'ation of suspended solids. Another study found that adding sodium bicarbonate, sodium chloride, sodium carbonate, sodium hydroxide, potassium bicarbonate, and potassium chloride to septic tank effluents decreased suspended solids and turbidity. (Snyder-FIRL)
W76-10012

DYNAMIC MODELLING AND CONTROL SIMULATION OF A BIOLOGICAL WASTE-WATER TREATMENT PROCESS,
Eidgenossische Technische Hochschule, Zurich (Switzerland). Laboratorium Technisch-Chemisches.
T. von Jeszenszky, and I. J. Dunn.
Water Research, Vol. 10, No. 5, p 461-467, 1976. 11 fig, 2 tab, 9 ref.

Descriptors: *Model studies, *Biological treatment, *Waste water treatment, Control systems, Recycling, Sludge treatment, *Simulation analysis.
Identifiers: Linear models, Monod models.

A dynamic control model of a two-stage reactor for biological treatment of waste water was developed. The rate of sludge recycle was manipulated according to exit substrate concentration deviations or entering substrate flow rate and concentration changes. The influence on process control of a Monod model and a linear model, with and without time delay functions, was investigated. The response of the system to sine variations of inlet concentration and flow was simulated by computer. Sludge recycle control provided substantial improvement for all models. On-off feedback control was best for linear models. Feedforward control was more effective for Monod kinetics. (Snyder-FIRL)
W76-10018

COMPUTER BASED CONTROL FOR WASTE-WATER SYSTEMS,
Greeley and Hansen, Chicago, Ill.
H. D. Gilman, E. F. Ballotti, and C. F. Guarino.
Consulting Engineer, Vol. 46, No. 4, p 46-48, April, 1976.

Descriptors: *Computers, *Waste water treatment, *Control systems, Automatic control, *Model studies, Monitoring.

The computer system is becoming an integral element in control of waste water treatment operations as well as monitoring. This has been noted in the upgrading of the water pollution control facilities in Philadelphia. Guidelines are provided for designing procedural models and documenting studies leading to the preparation of detailed specifications. The specifications should define what the supplier is to provide and delineate the information required by the supplier to form an operational data base. Specific computer performance is harder to specify then hardware, requiring significant written and diagrammed information. The information provided must include the types of information to be stored and displayed and the monitoring and control procedures required by the treatment system. The designs for plant monitoring and control are far more critical than data logging and reports, because integrating the computer into a control strategy is inherently a unique procedure. The computer control specification for a subprocess should include the names of all equipment, monitoring and control signals, descriptions of the monitoring and control requirements, control line diagrams, sample cathode ray tube displays, data and formats for printed logs and reports, alarm and status change log statements, storage of cumulative operation hours, process interface requirements, logic diagrams of the required computer operation procedures, and terminology. (Snyder-FIRL)
W76-10019

COMPUTER-AIDED ANALYSIS OF ENVIRONMENTAL DATA, PART I: LINEAR REGRESSION, PRECISION AND ACCURACY,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 5A.
W76-10022

COMPUTER-AIDED ANALYSIS OF ENVIRONMENTAL DATA, PART II: BIOCHEMICAL OXYGEN DEMAND MODEL,
Rensselaer Polytechnic Inst., Troy, N. Y.
For primary bibliographic entry see Field 5A.
W76-10023

SELECTIVE RENOVATION OF EUTROPHIC WASTES PHOSPHATE REMOVAL,
Consiglio Nazionale delle Ricerche, Bari (Italy). Instituto di Ricercha sulle Acque.
G. Boari, L. Liberti, and R. Passino.
Water Research, Vol. 10, No. 5, p 421-428, 1976. 5 fig, 5 tab, 20 ref.

Descriptors: *Sewage effluents, *Eutrophication, *Nutrient removal, *Phosphates, *Waste water treatment, Equilibrium, Chlorides, Recycling.
Identifiers: *Phosphate removal, Chloride/phosphate equilibrium.

As part of the development of a selective process to remove eutrophic species from sewage effluents, the chloride/phosphate equilibrium was studied for various ion resins and the selectivity dependence on several external or internal parameters was evaluated. After being converted into chloride or phosphate form, the resins were tested in columns or by allowing equilibrium to be reached in a flask. Hydrostatic interactions appear to have a great importance in determining resin selectivities in the chloride/phosphate system, but not in the chloride/sulfate equilibrium. The experimental results for the chloride/phosphate equilibrium would lead to selection of a secondary and tertiary amino, porous, 8 to 10% crosslinked, polyacrylic resin having diethylentriamine (DETA) basic groups for selective removal of phosphate from secondary effluents, with .001 to .006 M total concentration, low phosphate concentration, and 6.5 to 7.5 pH. Equilibrium phosphate uptakes were as high as 0.7 kg phosphate/kg dry resin. Resins having more hydrophilic matrices would require adequate physico-chemical stabilization. A possible alternative is once-through utilization of less chemically resistant resins, re-using the resins directly in phosphate form in soil conditioners or fertilizer. (Snyder-FIRL)
W76-10026

POLLUTION MONITORING DOESN'T HAVE TO BE COSTLY,
Hewlett-Packard Co., Loveland, Colo.
For primary bibliographic entry see Field 5A.
W76-10029

COST-EFFECTIVE GOAL,
D. E. Wright.
The Consulting Engineer, Vol. 40, No. 2, p 37, 39, February, 1976.

Descriptors: *Cost analysis, *Model studies, *Computer models, Engineering, *Sewage treatment, Performance, Design criteria, *Waste water treatment, Construction, Treatment facilities.
Identifiers: Cash flow.

An optimization study on sewage treatment carried out by the Construction Industry Research and Information Association (CIRIA) was reported. The process stages are linked by the right kinds of connections and the model responds properly to external stimuli, but assumptions and limitations are inherent in prototype models. Purposes of the study included correcting errors in the computer program and analyzing the sensitivity of the total annual cash flow (TACF) to particular design parameters or cost relationships. The model includes performance relationships, but users must provide cost information. Its results depend totally on the model structure and input data. Influent and effluent quality and various engineering parameters are considered along with TACF. An increase in interest rate or reduction of operating costs shifted the optimal solution away from the use of stages with high capital costs and low operating costs. The lowest number of process units, the maximum volume of individual process units, the cost per unit volume, and the drying-bed area were affected by increasing the model flow incrementally between 0.1 and 0.9 cu m/sec. Several alternative sludge disposal methods, each involving several steps, were compared at various flows. Values considered reasonable for leading design variables were compared with values optimized by the model. It is felt that the model should be developed further, improving performance relationships and economic calculations and adding new processes. (Snyder-FIRL)
W76-10032

DESIGNING MICROSCREENS. HERE'S SOME HELP,
Envirex, Inc., Waukesha, Wis. Water Quality Control Div.
E. P. Saffran, and R. A. Kormanik.
Water and Wastes Engineering, Vol. 13, No. 4, p 41-42, 44-45, April, 1976. 4 fig, 1 tab.

Descriptors: *Hydraulic design, *Mathematical models, Model studies, Equations, *Sewage treatment, *Biochemical oxygen demand, *Suspended solids, *Screens, Turbidity, Filtration, *Waste water treatment.
Identifiers: *Microscreens.

In determining the hydraulic capacity of a microscreen for design purposes, several parameters must be taken into account. These include the rate of clogging of the fabric, the rotational speed of the drum, the area of the submerged screen, the backwash efficiency, and the total head. Mathematical formulae have been derived for calculating filterability, headloss, and the permeability coefficient. Equations and their derivations are presented. Microscreens are used in conventional sewage treatment plants to polish secondary effluent. They have been effective in removing up to 50 to 80% suspended solids, 30 to 50% BOD, and 20 to 50% turbidity. The microscreens are generally sized based on hydraulic loadings in terms of gallons per minute per square foot of submerged area. (Kramer-FIRL)
W76-10033

DESIGN OF A STORMWATER SEWER BY NONLINEAR PROGRAMMING--1,
Sherbrooke Univ. (Quebec). Dept. of Civil Engineering.
P. F. Lemieux, Y. Zech, and R. Delarue.
Canadian Journal of Civil Engineering, Vol. 3, No. 1, p 83-89, March, 1976. 3 fig, 10 ref.

Descriptors: *Mathematical models, *Design criteria, *Sewers, *Pipes, Model studies, Hydrology, Cost analysis, Sewage treatment, Storm water, Drainage, *Waste water treatment.
Identifiers: Nonlinear programming.

Methodology for the design of a stormwater sewer using nonlinear programming has been developed. Pipe flows are calculated at the critical time for the system, using the hydrologic characteristics of the drainage surface. Next, a set of constraints are established for every pipe according to the pipe layout. Thirdly, an optimal solution is found by minimizing the system total cost subject to the constraints defined. A value is then added to the value of every continuous pipe diameter, and the highest standard diameter below or equal to that value is chosen. Finally, a post-optimal analysis is made of the piezometric surface to evaluate the sewer system performance. While the standard diameter solution is not optimal in a mathematical sense, it does lead to efficiency of design. Factors which influence an optimal solution are the inlet time at a node, excavation in soil or rock, ground slope, and Manning's n. (Kramer-FIRL)
W76-10034

MATHEMATICAL MODEL SIMPLIFIES DESIGN OF SLUDGE DRYING BEDS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
T. M. Walski.
Water and Sewage Works, Vol. 123, No. 4, p 64-65, April, 1976. 2 fig, 1 tab, 5 ref.

Descriptors: *Mathematical models, *Dewatering, *Sludge treatment, Equations, *Waste water treatment, Treatment facilities, Sludge disposal, Evaporation.
Identifiers: *Sludge drying beds.

Sand drying beds for the dewatering of sludge from small waste water treatment plants have proven economical. A typical sand drying bed is made up of a top layer of sand with an effective grain size of 0.3 to 0.75 mm, underlain by 6 to 12 inches of graded gravel. Wet sludge is placed on the beds, where it drains and dries until it can be lifted and hauled away. Design methods for sizing the beds are detailed, using a rational method to tabulate total bed area required each month. While the rational method is preferred over the empirical formula, it is still awkward to use. A simpler mathematical formula has been derived to account for the major sludge drying mechanism. This model is based on the time for sludge to drain, time for moisture to evaporate from drained sludge, moisture in inches, percent solids, and monthly rainfall. It was demonstrated that the required drying bed area was relatively insensitive to the depth to which the sludge is applied but was quite sensitive to variations in solids concentrations and to the effective evaporation. (Kramer-FIRL)
W76-10035

THE ROLE OF HYDROXYL RADICAL REACTIONS IN OZONATION PROCESSES IN AQUEOUS SOLUTIONS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
J. Hoigne, and H. Bader.
Water Research, Vol. 10, No. 5, p 377-386, 1976. 4 fig, 10 tab, 45 ref.

Descriptors: *Ozone, *Waste water treatment, *Kinetics, Biodegradation, Hydrogen ion concentration, Analytical techniques, Equations, Water treatment.
Identifiers: *Hydroxyl radicals.

A reaction scheme involving hydroxyl radical reactions in ozonation processes in water and waste water was investigated. The hypothesis tested was that the ozone may either react directly in substrates or above a critical pH value may decompose prior to reaction with substrates. Beyond the critical pH value, decomposition products of ozone such as hydroxyl radicals (OH) become the important oxidant. The critical pH-value above which the second type of reaction predominates depends upon both the rate which ozone reacts directly with the substrates and on the solutes, including reaction products, that enhance or retard ozone decomposition. Results obtained on aqueous model solution showed that reaction conditions for ozonation can be selected to favor either of the two postulated oxidation mechanisms. While the distinction between the two different mechanisms initiated by ozonation and the use of data available on each will provide a basis for optimizing the ozonation process, the reaction sequences for real waste water systems are more complex and must be analyzed for the individual cases. (Kramer-FIRL)
W76-10036

BIOCHEMICAL AND PHYSICAL PROPERTIES OF AN ACTIVATED SLUDGE ON SETTLING CHARACTERISTICS,
Institute of Public Health, Tokyo (Japan). Dept. of Sanitary Engineering.
Y. Magara, S. Nambu, and K. Utosawa.
Water Research, Vol. 10, No. 1, p 71-77, 1976. 12 fig, 1 tab, 18 ref.

Descriptors: *Activated sludge, *Flocculation, *Settling velocity, *Sewage treatment, *Waste water treatment, Physical properties, Biological treatment, Biological properties, Suspension, Sanitary engineering, Chemical properties, Polymers.
Identifiers: Sludge volume index, Poly-b-hydroxybutyrate.

Relationships between the settling characteristics of activated sludge floc and its biochemical and physical properties were investigated in a laboratory aeration tank. The sludge volume index increased and the settling velocity decreased with an increase in the organic load. Floc density proved to be the most significant physical property affecting floc settling characteristics. Improved floc settling characteristics were associated with increases in floc density and floc strength and with a decrease in floc size. Settling characteristics were also improved by decreasing the electrophoretic mobility due to the disappearance of extracellular polymers and poly-b-hydroxybutyrate during the process of metabolism. The extracellular polymer parameter was the most significant factor affecting activated sludge floc settling characteristics. (Kreager-FIRL).
W76-10037

ASSESSMENT OF THE MAXIMUM CONCENTRATION OF HEAVY METALS IN CRUDE SEWAGE WHICH WILL NOT INHIBIT THE ANAEROBIC DIGESTION OF SLUDGE,
Water Pollution Research Lab., Stevenage (England).
F. E. Mosey.
Water Pollution Control, Vol. 75, No. 1, p 10-20, 1976. 2 fig, 7 tab, 24 ref.

Descriptors: *Heavy metals, *Anaerobic digestion, *Equations, Solids removal, Sludge disposal, *Waste water treatment, Sludge treatment.

A method was developed to predict the effect of mixtures of heavy metals on the anaerobic digestion process. Two equations of similar form were obtained, one indicating conditions under which inhibition is expected, and the other indicating conditions under which the probability that digestion will not be inhibited is at least 90%. Both equations include the content of zinc, nickel, lead, cadmium, copper, and solids arriving or in digesting sludge. Digestion is also safeguarded from heavy metal inhibition when the total weight of these heavy metals in grams arriving daily in the crude sewage does not exceed 4939 times the average daily dry weight in tons of solids fed to the digester. Inhibition of other stages of treatment occurs at heavy metal concentrations similar to those that inhibit anaerobic digestion. The effects on the receiving stream and land on which the sludge is spread must also be considered when formulating suitable conditions. (Snyder-FIRL)
W76-10040

BIODEGRADABILITY AND TOXICITY STUDIES OF PHOTOGRAPHIC PROCESSING WASTES AT OFFUTT AFB, NEBRASKA,
Environmental Health Lab., Kelly AFB, Tex.
For primary bibliographic entry see Field 5C.
W76-10053

HYDROGEOLOGIC AND OTHER CONSIDERATIONS RELATED TO THE SELECTION OF SANITARY-LANDFILL SITES IN OHIO,
Ohio Dept. of Natural Resources, Columbus. Regional Geology Section.
G. H. Groenewold.
Information Circular Number 41, 1974. 15 p, 6 fig, 2 tab, 18 ref, 1 plate.

Descriptors: *Solid wastes, *Landfills, *Sites, *Leaching, *Leachate, *Water pollution, Groundwater, Water purification, *Ohio, Topography, Hydrogeology, Permeability, Porosity, Surface water, Glacial drift, Glacial soils, Water sources, Clays, Till, Shales, Geologic investigations, On-site investigations, Waste treatment, Waste disposal.
Identifiers: Landfill site selection, Leachate treatment.

Solid waste disposal by landfilling is widely practiced in Ohio. Proper landfill site selection is of major importance so as to prevent escape of toxic leachate and noxious gases from the disposal site. If the site is properly chosen, natural processes of filtration and purification will minimize the threat to ground-water contamination by infiltrating leachate. Major considerations include the topography and hydrogeology of the proposed site as well as the availability of suitable cover materials. Utilization of existing geologic, soil, as well as ground-water and surface-water information in conjunction with on-site investigation is of utmost importance in the proper selection of disposal areas. Sites having natural safeguards and not requiring excessive alteration are abundant in most areas of Ohio. In some localities leachate collection and treatment may be necessary to assure safe disposal. (Heiss-NWWA)
W76-10084

PL92-500: MID-COURSE CORRECTION GRANTS OPTIONS; NEXT MOVE UP TO CONGRESS,
For primary bibliographic entry see Field 5G.
W76-10106

EFFECTS OF TREATED MUNICIPAL WASTEWATER ON OAT FORAGE AND GRAIN,
Arizona Agricultural Experiment Station, Tucson.
A. D. Day, and R. M. Kirkpatrick.
J Environ Qual. 2(2), p 282-284, 1973.

Descriptors: *Oats, *Water reuse, *Crop response, Nutrient requirements, *Recirculated water, *Surface irrigation, Return flow, Waste water(Pollution), Reclaimed water, *Fertilization.

Experiments were conducted at Tucson, Arizona (USA) to study some effects of treated municipal wastewater on growth, yield and quality of oats (Avena sativa L.) grown for pasture forage and grain. No differences were observed in plant height, tillers per plant, green forage yield and total protein between forage grown with well water plus suggested amounts of N, P and K and forage grown with wastewater alone. Oats produced more dry forage when grown with well

water plus suggested N, P and K than when irrigated with wastewater. Wastewater produced forage with higher moisture content than well water plus N, P and K. When grown for forage, cultivars differed in plant height, dry forage yield and total protein content. Oat grain data showed no differences between irrigation and fertilizer treatments for maturity, plant height, panicles per unit area, grain yield and total protein. Well water plus suggested N, P and K resulted in fewer seeds per panicle and heavier seeds than wastewater. Cultivars differed in maturity, plant height, panicles per unit area, seeds per panicle, seed weight, grain yield and total protein. Treated municipal wastewater can be utilized to produce oats with grain yields and forage and grain protein contents approximately equal to those obtained when oats are grown with well water and suggested levels of N, P and K.--Copyright 1973, Biological Abstracts, Inc.
W76-10119

SWINE WASTE DIGESTION ENHANCEMENT WITH NUTRIENT SEPARATION,
Kansas Water Resources Research Inst., Manhattan.
L. A. Schmid, and R. I. Lipper.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-255 021, $4.00 in paper copy, $2.25 in microfiche. Completion Report, KWRRI Contribution No. 173, June 1976. 29 p, 3 fig, 6 tab, 31 ref, append. OWRT A-063-KAN(1), 14-31-0001-5016.

Descriptors: *Anaerobic digestion, *Farm wastes, Hogs, *Waste water treatment, Nutrients, Separation techniques, Carbon dioxide, Ammonia, Methane, Nutrient removal, Anaerobic bacteria, Gases.
Identifiers: *Swine wastes, Methane production, Ammonia removal, Carbon dioxide removal.

A swine waste anaerobic digester receiving the waste from 80 boars was operated for a period of ten months. Digester mixing and nutrient removal were accomplished by the recirculation of digester gases through two stripping units. Phosphoric acid was used to strip ammonia from the recirculated gas stream. Caustic solutions, primarily lime, were used to strip carbon dioxide. The removal of carbon dioxide resulted in an elevation of digester pH to 8.0. At the elevated pH ammonia was more readily stripped. A system specific ammonia desorption coefficient was determined which may be used for selecting gas flow rates. The selection of the proper gas flow rate can provide the required degree of ammonia removal to reduce ammonia concentrations to levels non-toxic to anaerobic bacteria. (Powers-Kansas State)
W76-10128

NITROGEN REMOVAL DEPENDS ON FORM NUTRIENT TAKES,
Metcalf and Eddy, Inc., Boston, Mass.
B. W. Behrman.
Water and Wastes Engineering, p 27-29, 46, February, 1976. 1 fig.

Descriptors: *Nitrogen, *Nitrites, *Ammonia, *Waste water treatment, *Biocontrol, Nitrogen fixing bacteria, Land use, Algae, Chlorination, Ion exchange, Economic feasibility, Bacteria, Water quality control.
Identifiers: Ammonia stripping, Breakpoint chlorination.

Most nitrogen in raw municipal wastewaters is in ammonia form, but 30-50% is usually associated with organic matter which may be biologically broken down to ammonia if the waste receives secondary treatment. Nitrifying bacteria may be used under certain conditions to convert some ammonia to nitrites and nitrates, which rarely occur in raw wastewater. Biological control technology involves specialized microorganisms to oxidize and/or remove wastewater N. Such methods are described and their benefits analyzed. Biological control can be accomplished by land application of wastewaters, although removal rates are highly variable and depend on application rates as well as the soil's pH, temperature, dissolved oxygen and organic carbon content. Another method involving harvesting algae has economic disadvantages. Three physical-chemical removal processes are ammonia stripping, breakpoint chlorination and selective ammonium ion exchange, none of which can remove N in the organic, nitrite or nitrate forms. Advantages and disadvantages of these techniques are described. Economic factors in various types of N control are also analyzed. (Jahns-Arizona)
W76-10174

AQUICULTURE - NEW BROOM CLEANS UP WASTEWATER,
Hazen and Sawyer, New York.
For primary bibliographic entry see Field 5G.
W76-10180

THE INFLUENCE OF THE SURFACE RUNOFF OF HEAVY RAINS ON THE CALCULATION OF SEWERS (UBER DEN EINFLUSS DES FLACHENABFLUSSES DER STARKREGEN AUF DIE BERECHUNG VON KANALISATIONEN),
H. Schulz.
Wasserwirtschaft-Wassertechnik, Vol. 26, No. 3, p 99-101, 1976. 5 fig, 2 ref.

Descriptors: *Sewers, *Storm runoff, Analytical techniques, *Combined sewers, *Drainage systems, Dimensioning, Retention, Flood frequency, Mathematical studies.
Identifiers: Space-time coefficient method.

A space-time coefficient method is described for the calculation of the influence of heavy rains on sewer dimensions. According to this method, the sewer system is dimensioned as a function of a retention coefficient, which is dependent of the sewer length per unit area and ultimately of the sewer length to flow rate ratio, and of a dynamic storage capacity, which is dependent of the orographic conditions. The usual reserves and safety margins are eliminated, which implies that the envisaged frequency of flood may actually occur. This frequency should be reduced accordingly for certain overflow in mixed sewer systems, retention basins or drainage canals in important urban and industrial agglomerations. (Takacs-FIRL)
W76-10197

THE EFFECT OF VARIOUS DESIGNS OF RAIN CATCHING BASINS ON THE POLLUTION OF THE RECEIVING WATER AND THE ECONOMY OF THE SEWER SYSTEM (DIE AUSWIRKUNG DER VERSCHIEDENEN BAUARTEN VON REGENUBERLAUFBECKEN AUF DIE SCHMUTZBELASTUNG DES VORFLUTERS UND DIE WIRTSCHAFTLICHKEIT DES KANALNETZES),
Stuttgart Univ. (West Germany). Institut fuer Siedlungswasserbau und Wasserguetewirtschaft.
K. Krauth.
Berichte der Abwassertechnischen Vereinigung e.V., No. 28, p 583-591, 1976. 6 fig, 1 tab, 4 ref.

Descriptors: *Basins, *Rain water, *Combined sewers, *Runoff, Bypasses, Watersheds(Basins), Rainfall, Design, Retention.

General considerations on the influence of rain catching basins on the pollution of recipients and on the economy of the mixed sewer system are presented. The efficiency of rainwater retention basins is apparent from the fact that the pollutant loads occurring during the initial phase of the rainwater runoff are multiples of the average load. Several basins should be linked in a by-pass system to prevent the discharge of runoff once retained in one basin into the recipient from the next one. Catchment basins are unable to retain the runoff during the later phase of many prolonged rain events. Basins of up to 500 cu m should be self-scavenging, and scavengers are necessary for larger units. For economic reasons, large areas should be subdivided into homogeneous zones of 20-40 ha each, with separate runoff retention basins in by-pass. (Takacs-FIRL)
W76-10198

SEWER PEST CONTROL CHECK VALVE,
For primary bibliographic entry see Field 8C.
W76-10199

APPARATUS AND METHOD FOR REMOVING POLLUTANTS FROM WASTEWATER,
Swift and Co., Chicago, Ill. (Assignee).
E. R. Ramirez, and D. L. Johnson.
United States Patent 3,959,131. Issued May 25, 1976. Official Gazette of the United States Patent Office, Vol. 946, No. 4, p 1738, May, 1976. 1 fig.

Descriptors: *Patents, *Waste water treatment, Treatment facilities, *Flotation, *Aggregates, Treatment, Equipment, Wastes, Separation techniques, Bubbles.

A patent for a raw waste water treatment system is described. The system includes a tank into which the waste water is introduced and a bubble introduction means located below and in communication with the tank for supplying a dense zone of fine bubbles to the tank. The pollutants in the waste water combine with the bubbles to form aggregates which remain unseparated from the waste water flow. The aggregates and treated waste water flow are removed through a transfer conduit to a flotation basin for separation of the pollutants and bubbles from the clarified waste water. (Kreager-FIRL)
W76-10200

CONTINUOUS RESPIROMETER APPARATUS FOR MONITORING SEWAGE OXYGEN CONTENT.
Robertshaw Controls Co., Richmond (Australia). (Assignee).
For primary bibliographic entry see Field 5A.
W76-10201

WASTE WATER TREATMENT.
Westinghouse Electric Corp., Melbourne (Australia).
Australian Patent 470,038. Issued March 4, 1976. Official Journal of Patents, Trade Marks and Designs, Vol. 46, No. 7, p 663, March, 1976.

Descriptors: *Waste water treatment, *Sewage treatment, *Sewerage, *Treatment facilities, *Patents, Separation techniques, Incineration, Disposal, Solid wastes, Liquid wastes, Filtration, Absorption, Colloids, Granules.

A waste water treatment system was patented. It includes an enclosure with an inlet adapted for receiving sewage influent for conditioning, separate liquid and solids outlets, and a liquid-solids separator in the enclosure receiving the influent to separate the solid and the liquid and to deliver the solids to the solids outlet. An incinerator which is associated with the outlet burns the solids delivered to it. A surge conditioning tank associated with the liquid outlet receives the liquid that has been separated. Chemical feed means connect with the tank to introduce chemical substances to condition the liquid. Filtration-absorption means connect with a tank outlet to remove colloidal material not removed by the separator. The filtration-absorption means include at least a stripper column with a mixture of various kinds of granules. One kind is chosen from materials having positive electrode potentials compared to hydrogen and another from materials having negative electrode potentials compared to hydrogen. (Snyder-FIRL)

W76-10202

PROCESS FOR DECONTAMINATING SEWAGE CONTAINING CYANIDE,
Heinrich Koppers Gesellschaft mit Beschrankter Haftung, Essen (West Germany) (Assignee).
H. Kloster, G. Preusser, and P. Radusch.
United States Patent 3,959,130. Issued May 25, 1976. Official Gazette of the United States Patent Office, Vol. 946, No. 4, p 1738, May, 1976.

Descriptors: *Waste water treatment, *Sewage treatment, *Sewerage, Chemical wastes, *Fly ash, *Patents, Hydrogen ion concentration, Separation techniques, Particle size.
Identifiers: *Cyanide.

A process for decontaminating sewage containing cyanide was patented. The cyanide is removed from sewage by maintaining the sewage in contact with a fly ash product produced during the gasification or combustion of coal dust, lignite, or coal at pH 7 or greater for 10 minutes or more. The fly ash product particles are smaller than approximately 25 microns. The sewage and the fly ash product are then separated. (Snyder-FIRL)
W76-10203

TREATMENT AND DISPOSAL OF SEWAGE SLUDGE,
Sterling Drug Inc., New York. (Assignee).
G. H. Teletzke.
United States Patent 3,959,125. Issued May 25, 1976. Official Gazette of the United States Patent Office, Vol. 946, No. 4, p 1737, May, 1976.

Descriptors: *Biological treatment, *Heat treatment, *Sludge treatment, *Patents, *Landfills, *Sewage sludge, Sludge disposal, Microorganisms, Seeds.

A process was patented to condition sewage sludge for land disposal. The sludge is rendered free of viable plant seeds and disease-producing microorganisms by heating it to between approximately 65 C and 150 C for between about 30 seconds and 60 minutes. The time and the temperature vary inversely. Without separating liquid and solid phases, the resulting fluid sterilized sewage sludge is biologically digested at a temperature between about 32 C and 60 C. (Snyder-FIRL)
W76-10204

SEWAGE HANDLING AND DISPOSAL PROCESS FOR CHLORIDE (NACL) CONTAMINATED SLUDGES,
Dorr-Oliver Inc., Stamford, Conn. (Assignee).
R. S. Millward.
United States Patent 3,959,126. Issued May 25, 1976. Official Gazette of the United States Patent Office, Vol. 946, No. 4, p 1737, May, 1976.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Sewerage, *Treatment facilities, *Sewage sludge, Biological treatment, *Sodium chloride, Centrifugation, Chlorides, Saline water, Desalination.

A method was patented to treat sewage that contains sodium chloride from infiltration by salt water. It is suitable for sodium chloride concentrations that become corrosive at temperatures used to sterilize sludge. The sewage is treated to produce biologically treated sludge. This biologically treated sludge is centrifugally separated and concentrated in a nozzle type centrifuge. An underflow fraction with a controllable concentration and a overflow separated liquid fraction are delivered through the machine's nozzles. Wash water is fed into the separating chamber at a rate effectively blocking sodium chloride from discharging with the underflow fraction by displacing the sodium chloride by the wash water toward overflow, delivering underflow sludge substantially free of sodium chloride and an overflow that contains the displaced sodium chloride. This underflow sludge is heated by passing through heating apparatus which could otherwise be corroded by the sodium chloride at sterilizing temperatures. (Snyder-FIRL)
W76-10205

TRACTION-DRIVEN COMPOSITE SLUDGE RAKING MECHANISM FOR SEDIMENTATION TANKS,
Dorr-Oliver, Inc., Stamford, Conn. (Assignee).
J. A. Seifert, D. R. Hill, and M. Smith.
United States Patent 3,959,152. Issued May 25, 1976. Official Gazette of the United States Patent Office, Vol. 946, No. 4, p 1746, May, 1976. 1 fig.

Descriptors: *Patents, *Sludge treatment, *Sediment discharge, *Settling basins, *Sediment control, *Waste water treatment, Treatment facilities, Sedimentation, Treatment, Equipment, Sediments, Wastes.

A patent for a sludge raking mechanism for sedimentation tanks is described. A bladed rake arm extends from the lower end of a vertical cage structure surrounding a center pier near the discharge means of a settling tank and swings from a predetermined lowermost normal raking position to move the sludge toward the discharge means. The rake arm yields upwardly along the predetermined path when excessive sediment accumulation in the inner zone of the settling tank occurs. An outer complementary raking means functions to move light sedimentation sludge loads from an outer annular zone to the inner zone of sedimentation sludge accumulation. (Kreager-FIRL)
W76-10206

WASTE TREATMENT PROCESS,
Alar Engineering Corp., Chicago, Ill. (Assignee).
H. R. White, and A. J. Doncer.
United States Patent 3,959,129. Issued May 25, 1976. Official Gazette of the United States Patent Office, Vol. 946, No. 4, p 1737-1738, May, 1976. 1 fig, 1 tab.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Chemical reactions, *Solubility, *Filtration, Treatment, Wastes, Adhesives.
Identifiers: Printing wastes, Paper board wastes.

A patent involving a process for treating waste waters derived from the clean-up of at least one water-based flexographic printing ink and from the clean-up of at least one starch based adhesive used in corrugated paper board manufacturing is described. The process involves the addition to the waste water of 500-5000 ppm of dissolved, water-soluble iron salt (selected from ferrous sulfate, ferric sulfate, or ferric chloride); agitation of the resulting mixture for a period of 20 min to 4 hr; mixing the agitated mixture with 500-5000 ppm of calcium hydroxide (composed of particles less than 250 micron); agitation of the resulting mixture for a period of 20 min to 4 hr; and the continuous passage of the resulting mixture over the surface of a rotating drum vacuum filter assembly which is coated with a layer of water-insoluble, inert particulate material having a particle size less than about 250 microns. The aqueous portion of the mixture is simultaneously withdrawn through the surface portion of the rotating drum, while the filter cake deposited on the outer surface portion of the drum is moved along a longitudinal path of the drum. The waste water treated should contain à 4000-60,000 ppm of suspended solids with an average diameter below about 200 milli-micron and 1-6 weight % non-aqueous matter. (Kreager-FIRL)
W76-10207

METHOD AND APPARATUS FOR THE ACTIVATED SLUDGE TREATMENT OF WASTEWATER,
Sweco, Inc., Los Angeles, Calif. (Assignee).
G. Tchobanoglous.
United States Patent 3,959,124. Issued May 25, 1976. Official Gazette of the United States Patent Office, Vol. 946, No. 4, p 1736-1737, May, 1976. 1 fig.

Descriptors: *Patents, *Waste water treatment, *Activated sludge, *Aeration, *Screens, Treatment facilities, Equipment, Wastes, Treatment, *Sludge treatment.

A patent for an activated sludge waste water treatment method and apparatus is described. The apparatus includes an aeration basin and a secondary clarifier along with a screening means arranged for receiving at least a portion of the flow from the aeration basin for solids removal. The screening means includes at least one screen and a distribution means for directing the flow with a substantial relative movement itself and the screen so that the screen is maintained unclogged. The screening means divides the flow into a screened effluent and a concentrate. The former is directed to the secondary clarifier and the latter to the aeration basin for control of the mean cell residence time in the aeration basin. (Kreager-FIRL)
W76-10208

RECIRCULATING SEWERAGE SYSTEM,
Koehler-Dayton, Inc., New Britain, Conn. (Assignee).
F. J. Bogusz.
United States Patent 3,958,279. Issued May 25, 1976. Official Gazette of the United States Patent Office, Vol. 946, No. 4, p 1460, May, 1976. 1 fig.

Descriptors: *Sewage treatment, *Waste water treatment, *Sewerage, *Recycling, *Patents, *Treatment facilities, Equipment, Treatment, Sewage disposal, Waste disposal, Wastes, Sewage effluents.

A patent for a recirculating sewerage system is described. The sewage system consists of a toilet, a recirculating tank, a drain conduit which communicates with the bottom of the recirculating tank, a valve for controlling the gravitational flow of sewage from the recirculating tank through the drain conduit, and a means for directing the effluent from the toilet into the recirculating tank. When the system is operated in the flushing mode, a means for energizing a pump communicating with the recirculating tank is provided along with a means for recirculating the effluent discharged by the pump to the toilet for flushing purposes. Means are also provided for operating the system in a drain mode whenever the recirculating tank is to be drained. (Kreager-FIRL)
W76-10209

WHAT TO DO WITH SEWAGE SLUDGE.
Mosaic, Vol. 7, No. 3, p 20-28, May-June, 1976. 1 fig.

Descriptors: *Sewage sludge, *Sewage disposal, *Waste water treatment, *Land use, Odor, Heavy metals, Groundwater, Water pollution sources, Microorganisms, Irradiation.
Identifiers: Land application.

Higher degrees of purification of waste water are producing larger amounts of sludge, at the same time that it is becoming more difficult to dispose of. Application to land is considered more practical than burning or disposal at sea. Problems with application to land include the heavy metal content of the sludge, odor, and objections from local residents. Most existing sludge disposal options seem to have serious drawbacks. Research is underway on the economic and health problems of land disposal. One system being studied involves injection of sludge under the soil surface. Potential

problems with the method include nitrate pollution of groundwater, contamination of crops with heavy metals, and infection of soil and groundwater with microorganisms. The extent of these problems varies with sludge, soil, and moisture conditions. Microorganisms pose the most serious problem. Irradiation of sludge is being studied as a means of inactivating pathogenic agents. (Snyder-FIRL)
W76-10210

HYDROGEN PEROXIDE SOLVES SLUDGE ODOR PROBLEM,
Appleton Public Works, Wis.
R. G. Miller.
Water and Sewage Works, Vol. 123, No. 5, p 74-76, May, 1976. 1 fig.

Descriptors: *Waste water treatment, *Activated sludge, *Treatment facilities, *Sludge treatment, *Dewatering, Odor, Hydrogen sulfide, Industrial wastes, Domestic wastes.
Identifiers: Hydrogen peroxide, *Odor control.

An extreme problem with hydrogen sulfide odor from sludge dewatering at a waste treatment plant was solved using hydrogen peroxide treatment. The activated sludge plant serves Appleton, Wisconsin, treating both residential and industrial waste. A classical pattern of primary and secondary treatment is used. The filter room odor problem had existed ever since the secondary treatment facility began operation. The dewatered sludge disposed of on land also emitted a sulfide odor. Hydrogen peroxide, which controls hydrogen sulfide odors by breaking down hydrogen sulfide into elemental sulfur and water, was tested for effectiveness. The hydrogen peroxide was injected into a main between the storage tanks and the vacuum filters, to remove the sulfide producing slimes that populated the mains. Injection at 50 ppm resulted in no sulfides or odor in the sludge and no hydrogen sulfide in the atmosphere. The sulfide odor in the filter room also disappeared, and the hydrogen peroxide was easy to store and inject. This method of odor control was instituted immediately after it was proved effective. (Snyder-FIRL)
W76-10211

TREATMENT OF WASTE WITH OXYGEN OR OZONE.
Commonwealth Industrial Gases, Ltd., Sydney (Australia).
Australian Patent 470,115. Issued March 4, 1976. Official Journal of Patents, Trade Marks and Designs, Vol. 46, No. 7, p 683, March, 1976.

Descriptors: *Liquid wastes, Waste treatment, *Patents, *Ozone, *Oxygen, *Waste water treatment, Recycling, Chemical oxygen demand.

A process for treating liquid wastes with oxygen or ozone has been patented. Such wastes have an oxygen demand sufficient that when the liquor is contacted with a treatment gas having an oxygen content in the range 70 to 95% by volume, at least a part of the effluent gas produced is subjected to an enrichment step. This will restore its oxygen content to the treatment level. The oxygen is then recycled. (Kramer-FIRL)
W76-10212

FOUR-MODE TREATMENT PLANT WILL GENERATE SODIUM HYPOCHLORITE ONSITE.
The American City and County, Vol. 91, No. 5, p 22, May, 1976.

Descriptors: *Waste water treatment, *Activated sludge, *Biochemical oxygen demand, *Treatment facilities, *Sodium compounds, Sea water, Disinfection, Aeration, Suspended solids, Sludge disposal, Dewatering, Incineration, Connecticut.
Identifiers: *Sodium hypochlorite.

Seawater will be used for generating sodium hypochlorite for use as a disinfectant in a waste water treatment plant being constructed in New Haven, Connecticut. Volume and strength of the waste water and Connecticut State requirements dictated design of a flexible aeration system. The aeration process includes four modes: conventional activated sludge to treat low-strength domestic wastes, a complete-mix process to protect against shock loads, step aeration for better oxygen utilization which periodically may be required, and contact stabilization because land for later staged expansion is unavailable. Adjustable outlet weirs, either automatically or manually operated, will control the water levels of the aeration basins to provide the required extent of oxygen transfer. Warm, screened seawater, previously used for condenser cooling, will be obtained from an electric generating station outfall near the treatment plant. After degritting, gravity thickeners and centrifuges will thicken the primary sludge, and primary and thickened waste activated sludge will be mixed. A reactor will oxidize volatile sludge solids; insoluble volatile matter in the sludge is reduced by 30%, and the oxidized sludge is then thickened. The dewatered sludge will be disposed of in a multiple hearth incinerator. The facility, which is scheduled for completion in 1979, will be able to handle 100 mgd peak flow and will reduce biochemical oxygen demand (BOD) and suspended solids by 90%. (Snyder-FIRL)
W76-10213

WHAT'S NEW IN OZONATION, OXYGENATION, REVERSE OSMOSIS AND ULTRAFILTRATION.
Modern Power and Engineering, Vol. 70, No. 4, p 44, April, 1976.

Descriptors: *Ozone, *Reverse osmosis, *Waste water treatment, *Sewage treatment, *Recycling, Sewage treatment, Effluents, Industrial wastes, *Oxygenation, Filtration.
Identifiers: *Ultrafiltration, Ozonation.

Ozonation techniques for both industrial and municipal waste treatment have increased in recent years and wider applications of ozone to sewage treatment plant effluents have been developed. Since ozone treatment removes contaminants without producing known toxic materials and simultaneously increases the dissolved oxygen levels of the treated waters, emphasis on recycling and reuse of process waters has encouraged renewed interest in the study of ozonation processes. The performance of ozone equipment has improved significantly and costs of producing ozone have been greatly reduced. One United States ozone manufacturer even promises ozone disinfection of water at the same prices as chlorination. Other growing technologies for treating municipal and combined municipal-industrial waste waters are detailed. These include oxygenation, reverse osmosis, and ultrafiltration. (Kramer-FIRL)
W76-10214

EXPERIMENTS ON RAPID SAND FILTRATION OF BIOLOGICAL SEWAGE TREATMENT-PLANT EFFLUENTS (UNTERSUCHUNGEN UEBER DAS VERHALTEN VON SCHNELL-SANDFILTERN BEI DER FILTRATION EINES BIOLOGISCH GEREINIGTEN KLAERAN-LAGENABLAUFS),
B. Hanisch, V. Mayer, and B. Zacher.
Wasserwirtschaft, Vol. 66, No. 5, p 144-147, 1976. 5 fig, 4 tab, 3 ref.

Descriptors: *Waste water treatment, *Sewage treatment, *Treatment facilities, *Filtration, Sands, *Biological treatment, Filters, Biochemical oxygen demand, Pilot plants, Activated sludge.
Identifiers: Upflow filters, *Sand filtration.

Part of the residual biochemical oxygen demand (BOD) in the effluent of biological sewage treatment plants is produced by small floc particles, which are not retained in the final sedimentation tanks. According to experiences in Great Britain, rapid filtration in sand filters can effectively remove these suspended solids. Downflow filters of the kind used for water treatment were used earlier; more recently, upflow filters have also been used. Some results of experiments with filters at The Institut fuer Siedlungwasserbau und Wassergutewirtschaft in Stuttgart-Busnau are reported. These experiments are directed toward correlating the most important parameters of the process. Activated sludge plant effluent, treated in pilot rapid sand filters of both types, is less highly nitrified than was reported for the plants in Britain. (Snyder-FIRL)
W76-10215

USE OF THE EARTH'S CRUST FOR TREATMENT OR STORAGE OF SEWAGE EFFLUENT AND OTHER WASTE FLUIDS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
H. Bouwer.
CRC Critical Reviews in Environmental Control, Vol. 6, No. 2, p 111-130, March, 1976. 1 fig, 2 tab, 97 ref.

Descriptors: *Waste water treatment, *Underground storage, *Waste storage, *Sewage effluents, *Liquid wastes, Land use, Irrigation, Organic wastes, Nitrogen.
Identifiers: Land application.

Land application or underground storage of liquid wastes may be most feasible in a number of situations. Surface application usually is restricted to wastes with mostly organic pollutants. Low-rate systems involve using secondary or equivalent treated effluent to irrigate crops. The amount of nitrogen applied to the soil by sewage sludge is not much more than the crop can remove, but the system must stimulate denitrification for animal waste slurries. Damaging effects of metals can be minimized by lime addition and by growing relatively insensitive crops. Boron is adsorbed by components in some soils. Due to the amount of land needed, low-rate systems are generally used only for small capacity. Overland flow systems, in which waste water flows over sloping fields, can significantly improve quality if the loading rates are relatively low. High rate systems require less land, but the renovated water is usually intercepted to prevent spreading into the aquifer. It can be intercepted by choosing a location where it drains naturally into surface water, or by drains or wells. The water table should not rise high enough below the infiltration area to restrict infiltration. Infiltration and drying periods are generally alternated. Because land treatment is so dependent on local conditions, use of a pilot system for at least one year is desirable. Land treatment costs depend on the cost of the land needed, its distance from the treatment plant, and the cost of wells or drains to collect the renovated water. (Snyder-FIRL)
W76-10216

OPTIMIZING CENTRIFUGE DECANTATION FOR SLUDGE THICKENING (OPTIMISATION DES DECANTEUSES CENTRIFUGES POUR LA CONCENTRATION DES BOUS),
Alfa-Laval A. B., Tumba (Sweden).
L. Kallstrom.
Techniques et Sciences Municipales -- L'Eau, No. 3, p 141-143, March, 1976. 4 fig.

Descriptors: *Treatment facilities, *Centrifugation, *Sludge treatment, *Industrial wastes, Sludge, Flocculation, Effluents, Optimization, On-site tests, *Waste water treatment.
Identifiers: *Centrifuge decantation.

Optimizing a decantation centrifugation installation consists in establishing an equilibrium between yield and economy, and achieving max-

imum capacity, sludge dryness, and clarity of effluent with minimum energy and chemical expenditure. Adjustment of the installation involves a number of parameters such as rotor and conveyer speeds, and volume of liquid in the rotor. Rate and dosage of the flocculant are then adjusted together by one of two methods or a combination of both; with the first, a feeding rate is chosen significantly lower than the theoretical maximum, thereby increasing transit time and the quantity of fine particles on the rotor. With the second method, more flocculant is used to gather the fine particles into larger flocs which will be deposited more quickly in the force field of the centrifuge. A combination of both is frequently chosen in view of economic considerations. (Waltner-FIRL)
W76-10217

BUFFERING AIDS DIGESTION OF WASTE.
Chemical Week, Vol. 118, No. 23, p 51, June 9, 1976. 1 fig.

Descriptors: *Waste water treatment, *Biological treatment, *Biochemical oxygen demand, Treatment facilities, *Sodium compounds, Bicarbonates, Digestion, Hydrogen ion concentration, Trickling filters.
Identifiers: *Sodium bicarbonate, Buffering, Waste digestion.

Municipal waste treatment plants work better when buffered with sodium bicarbonate. Sodium bicarbonate use enabled the 37-yr old Hightstown plant, which was once slated for replacement because it could not meet Environmental Protection Agency standards, to operate well within EPA limits. Septic tank users have also reported that sodium bicarbonate additions increased tank life. Some municipal waste treatment plants use sodium bicarbonate on a spot basis to improve alkalinity. It was considered the 'best alkaline chemical' to adjust pH without danger of overdosage. Sodium bicarbonate also reduces biochemical oxygen demand (BOD), sulfide odors, corrosion, and sludge-handling costs; increases solids settling, toxic-pollutant removal, and methane production; and controls nitrification. Rejuvenating the one million-gal/day trickling-filter, biological waste treatment plant in Highstown was the first major project using sodium bicarbonate. Adding sodium bicarbonate to the waste influent and digester produced a return of bacterial activity to the trickling filter and reduced BOD from 36 to 7. Sodium bicarbonate can also significantly reduce sludge volume. Sodium bicarbonate costs more per ton than other waste treatment chemicals, but usually only half the volume of sodium bicarbonate is needed. Sodium bicarbonate is also easier and less hazardous to handle than many chemicals. Although some large plants use sodium bicarbonate for functions such as neutralization and methane production, most users are expected to be small plants where sophisticated equipment is unaffordable. (Snyder-FIRL)
W76-10218

WASTEWATER RENOVATION AND REUSE: VIRUS REMOVAL BY SOIL FILTRATION,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
R. G. Gilbert, R. C. Rice, H. Bouwer, C. P. Gerba, and C. Wallis.
Science, Vol. 192, No. 4243, p 1004-1005, June 4, 1976. 1 tab, 10 ref.

Descriptors: *Waste water treatment, *Sewage treatment, Treatment facilities, *Filtration, Sewage effluents, *Reclaimed water, Groundwater, Viruses, *Water reuse, Soils.
Identifiers: *Soil filtration, *Virus removal.

Renovated water and secondary sewage effluent from four wells at the Flushing Meadows Wastewater Renovation Project, a land disposal project near Phoenix, Arizona, operating since 1967, were sampled about every 2 months in 1974 during flooding periods. The samples were assayed for viruses by bottle culture and the overlay method, using primary kidney cells from immature baboons. The number of viruses detected in the sewage effluents averaged 2118 per 100 liters with a minimum of 158 per 100 liters and a maximum of 7475 per 100 liters. Seven types of viruses were identified, whose occurrence varied seasonally. No viruses were detected in renovated water samples. Apparently human viral pathogens do not move through soil into groundwater, but are absorbed and degraded by the soil, their numbers being reduced by a factor of at least 10,000. (Snyder-FIRL)
W76-10219

GENERAL CONSIDERATIONS IN WASTEWATER DISINFECTION,
Ontario Ministry of the Environment, Toronto. Wastewater Treatment Section.
F. A. Tonelli.
Water and Pollution Control, Vol. 114, No. 5, p 23-24, 28, 30, 46-47, May, 1976. 1 fig, 9 tab.

Descriptors: *Waste water treatment, *Disinfection, *Chlorination, *Gamma rays, *Pathogenic bacteria, Coliforms, Aquatic microorganisms, Resistance.
Identifiers: *Gamma irradiation.

The objective of waste water disinfection is to destroy pathogens before discharging the waste water. Because of the varied resistance of microorganisms to any disinfectant, more than one organism should be used to assess efficiency. Total coliforms or fecal coliforms are usually used. Chemical conditions in the waste water determine the chemical reactions undergone by added chlorine; the effectiveness as a disinfectant varies for different chlorine compounds. Efficiency of disinfection can be seriously impaired at lowered temperatures. Contact time and residual are equally important in determining coliform kill. Thorough initial mixing of concentrated chlorine solution and bulk waste water is necessary for optimum disinfection. A contact chamber with highly developed plug flow characteristics is desirable, so that detention time can be known with some certainty and back mixing can be avoided as much as possible. Process control for chlorination involves maintaining a specified residual at the end of the chlorine contact chamber detention period; methods include manually setting the chlorine addition rate, flow-paced chlorine application, and compound loop control, in order of increasing complexity. Reaction with sulfur dioxide is currently the best developed dechlorination process, but excess sulfur dioxide can increase the oxygen demand of the effluent and depress the pH of the waste water. (Snyder-FIRL)
W76-10220

APPLICATION OF ACTIVATED SLUDGE DESIGN AND OPERATION,
Oklahoma State Univ., Stillwater.
T. L. Bentley, and D. F. Kincannon.
Water and Sewage Works, Reference number, p R10-R-13, April 30, 1976. 9 fig, 1 tab, 14 ref.

Descriptors: *Trickling filters, *Biological treatment, *Aerobic treatment, *Activated sludge, *Biodegradation, Treatment, Equipment, Chemical oxygen demand, Microorganisms, Evaluation, Performance, *Waste water treatment.

Parameters affecting the operation and performance of laboratory-scale biological towers (trickling filters) were investigated and compared with those commonly used to describe activated sludge processes. Sucrose was used as the carbon source and growth-limiting nutrient for a prepared synthetic waste used in the investigation. The parameter food to microorganism ratio and mean cell residence time which are used for designing activated sludge systems were also found suitable for describing the operation of trickling filters. A comparison of both treatment processes with the same loading parameters resulted in similar treatment efficiencies being obtained. Treatment efficiencies of 95% were obtained in each case for food to microorganism ratios of 0.5. Variation in the percent of chemical oxygen demand removal as a function of mean cell residence time for the experimental trickling towers was also similar to curves obtained for activated sludge systems. (Kreager-FIRL)
W76-10221

BIOLOGICAL TREATMENT PROCESS IN COLD CLIMATES,
CH2M/Hill, Corvallis, Oreg. Wastewater Reclamation.
J. D. Boyle.
Water and Sewage Works, Reference number, p R-28, R-30, R-32-R-34, R-37-R-38, R-43-R-44, R-46, R-48, R-50, April 30, 1976. 16 fig, 2 tab, 9 ref.

Descriptors: *Biological treatment, *Aeration, *Activated sludge, *Trickling filters, *Temperature, *Kinetics, *Waste water treatment, Equipment, Treatment facilities, Performance, Biochemical oxygen demand, Heat transfer, Cold regions, Climates.

The effects of cold climates on three aerobic biological treatment processes are examined. The treatment processes considered are: extended aeration and conventional activated sludge systems utilizing air as an oxygen source, oxygen-activated sludge systems (covered and uncovered), and activated biological filtration systems (activated sludge and trickling filter combination). Temperature-sensitive parameters discussed include: effluent biochemical oxygen demand, solids production, aeration requirements, horsepower requirements, and heat loss. Housing the biota within a process that is able to resist the adverse effects of low temperature on the processes' kinetics can significantly improve the cold weather performance of biological treatment systems. (Kreager-FIRL)
W76-10222

VERTICAL STATIC TUBE AERATORS: EVALUATING THEIR PERFORMANCE,
Associated Engineering Services, Ltd., Vancouver (British Columbia).
M. J. Stewart, and T. R. Lidkea.
Water and Sewage Works, Reference number, p R80-R84, April 30, 1976. 5 fig, 2 tab, 10 ref.

Descriptors: *Aeration, *Oxygen, *Transfer, *Rates, *Waste water treatment, Equipment, Evaluation, Performance, Testing procedures.
Identifiers: *Aeration, Vertical static tube.

A procedure for finding the oxygen transfer rate of vertical static tube aerators based on the oxygen concentration versus lapsed time of aeration values obtained during a given test run is described. The procedure consists of the following steps: an evaluation of the oxygen saturation concentration which has been corrected for site barometric pressure, mid-depth, water pressure, and water vapor pressure; calculation of the oxygen transfer coefficient by plotting the difference between the oxygen saturation concentration and the oxygen concentration in a water sample collected at a given time versus the time on semilog paper; correction of the oxygen transfer coefficient to 20 C; calculation of the true (mid-depth) oxygen transfer rate under standard conditions using the oxygen transfer coefficient at 20C; and calculation of the transfer rate at the waste water treatment plant site under operating conditions. (Kreager-FIRL)
W76-10223

THE DISPOSAL OF SEWAGE FROM COASTAL TOWNS: THE CASE FOR TREATMENT,
E. C. Whitaker.

Water Pollution Control, Vol. 75, No. 2, p 146-152, 1976. 3 fig.

Descriptors: *Oceans, *Sewage treatment, *Sewage effluents, *Sewage disposal, *Sewage, Beaches, Decision making, Treatment facilities, Public health, *Outfall sewers, *Waste water treatment.

Factors leading to the decision to install an inland sewage treatment plant at a British coastal town are reviewed. Prior to the treatment plant installation, direct outfall discharge to the sea was observed up to 600 m offshore, and sewage was often observed on high water marks. More than 10,000 kg of litter was removed daily over a 3-kilometer stretch of the coastal beach area. Factors other than pollution of the beaches which contributed to a decision to install an inland treatment plant included: the potential health hazard associated with direct sewage discharge, a rapid increase in housing development with no drainage except cesspools, and flooding as a result of overloaded sewers. (Kreager-FIRL)
W76-10225

DIFFUSED AIR IN DEEP TANK AERATION,
Water Pollution Control Corp., Milwaukee, Wis.
F. L. Schmit, P. M. Thayer, and D. T. Redmon.
Water and Sewage Works, Reference number, p R-86-88, R-90, R-92-R-93, April 30, 1976. 9 fig, 3 tab, 16 ref.

Descriptors: *Aeration, *Efficiencies, Oxygen, *Oxygenation, Waste treatment, Equipment, Evaluation, Performance, *Waste water treatment, Tanks.
Identifiers: *Oxygen transfer, Tank geometry, *Aeration tanks.

Factors affecting oxygen transfer efficiencies and power requirements of deep tank aeration systems were investigated using a steel tank 34 ft in. wide by 6 ft long by 24 ft deep. Temporary baffles were used to permit the evaluation of two tank widths. For a given oxygen transfer capability, a tank width of 34 ft 4 in was more efficient than a tank width of 19 ft 3 in with the same water depths and submergences. Increased air rates showed an increase in percent oxygen absorption and transfer capability of the diffusers for all tank geometries, depths, and air rates tested at a fixed water depth and submergence. Adiabatic power requirements of transferring a given amount of oxygen were reduced as tank depths increased, regardless of the tank width. An extrapolation of the data obtained over tank depths of 13-23 ft revealed that advantages of deep tank construction apply to depths significantly greater than 23 ft. The extrapolation also indicated that at some depth beyond 23 ft narrower tanks may require less power for a given oxygen transfer. (Kreager-FIRL)
W76-10226

IMPORTANT CONSIDERATIONS IN DESIGNING ACTIVATED SLUDGE PROCESSES,
Peabody Welles Inc., Roscoe, Ill. Research and Development Div.
J. D. Walker.
Water and Sewage Works, Reference number, p R-54, R-55-R-58, R-60-R-62, April 30, 1976. 5 fig, 1 tab, 1 ref.

Descriptors: *Activated sludge, *Waste water treatment, *Reaeration, Biological treatment, Equipment, Performance, Biochemical oxygen demand, Chemical oxygen demand, Mixing, Design criteria.

Design considerations for air-operated activated sludge processes are discussed. Topics covered include: reaeration, rapid blending of the activated seed sludge with the substrate, air diffuser spacing and placement, clumping tendencies in activated sludge floc, rotary positive blowers, and centrifugal blowers (single stage and multistage). A modification to plug flow activated sludge systems known as complete mixing offers the advantage of blending out high strength, highly soluble biochemical oxygen demand-chemical oxygen demand within the reactor; however, the return seed sludge often requires substantial reaeration to avoid a sludge bulking problem and consequent solids loss to the effluent. The extent of the reaeration should be substantial, for example, at least one-fourth to one-fifth of the detention period, even in plants with high space loadings. Contact stabilization and step feed (both with substantial return activated sludge reaeration) are examples of the application of meaningful reaeration. (Kreager-FIRL)
W76-10227

SMALL SEWAGE WORKS THAT FUNCTION SATISFACTORILY,
Southern Water Authority, East Sussex, (England). East Sussex Water and Drainage Div.
D. H. Banks.
Water Pollution Control, Vol. 75, No. 75, No. 2, p 162-175, 1976. 14 ref.

Descriptors: *Sewage treatment, *Rural areas, *Treatment facilities, *Administration, *Project planning, *Scheduling, Decision making, Economics, *Waste water treatment.
Identifiers: Great Britain, England, Wales.

The status of small rural sewage works throughout England and Wales is reviewed along with options for future design. Over 80% of the more than 5000 sewage treatment plants in England and Wales are administered by rural district councils, indicating the number of smaller sewage treatment plants that have been inherited by 10 newly established water authorities. No radical policy of treatment centralization is expected in view of potential problems associated with constraints in the shape of costly outfall sewers, the possible need for pumping, and the questionable desirability of concentrating effluent discharges into one receiving watercourse. Options available for future sewage works design and construction include: sewage works designed for construction in stages, the design and construction of works with capacities for an ultimate population, and the design of works capable of further expansion. The construction of sewage works which have a life of 30 years or more is considered to be undesirable due to the rate of technological development and change in the sewage treatment field. (Kreager-FIRL)
W76-10228

THAMES WATER OPENS STANFORD RIVERS SEWAGE TREATMENT WORKS,
Water Services, Vol. 80, No. 962, p 248, April, 1976.

Descriptors: *Treatment facilities, *Sewage treatment, *Municipal wastes, *Waste water treatment, Treatment, Equipment, Sludge treatment, Sedimentation, Sewage lagoons, Lagoons.
Identifiers: Great Britain, England.

The opening of the Stanford Rivers Sewage Treatment Works by the Thames Water Authority is described. The new works serve a population of about 12,000 and have a daily inflow of 2500 cu m/day. The sewage treatment works were built in two stages. The first stage involved the provision of a central collection point for sludge treatment and pressing from outlying works and included the construction of sludge holding tanks, mixing tanks, a pumping station, and press house. The second stage called for the rebuilding of treatment facilities to increase capacity and improve the effluent standard and involved the installation of new inlet works, sedimentation tanks, effluent lagoons, a screw pumping house, and ancillary facilities. (Kreager-FIRL)
W76-10229

VIRUS REMOVAL IN AN ACTIVATED SLUDGE PLANT,
Hamilton County Community Development, Tenn.
J. D. Naparstek, K. Kawata, V. P. Olivieri, and V. R. Sherman.
Water and Sewage Works, Reference number, p R-16, R-20, April 30, 1976. 1 fig, 2 tab, 3 ref.

Descriptors: *Activated sludge, *Viruses, *Municipal wastes, *Domestic wastes, *Waste water treatment, Treatment facilities, Evaluation, Performance, Microorganisms, Efficiencies, Wastes, Treatment, Sludge, Chlorination, Chlorine.
Identifiers: f2 virus, *Virus removal.

Virus removal studies at a step aeration activated sludge plant in Maryland City, Maryland were conducted. The plant has a design capacity of 750,000 gallons/day and treats primarily domestic waste from residences along with some commercial waste. An f2 model virus was used to seed the influent of the plant, with the resulting seed virus concentration being 1 million plaque forming units/ml as compared with a background virus concentration of between 100 and 10,000 plaque forming units. The average cumulative virus removal throughout the plant was 80.5%. The most significant virus removals occurred in the plant's chlorine contact basin and averaged 72.0%. Virus reductions in the preliminary units, the primary basin, the aeration tank and secondary basin, and sand filters used throughout the process averaged 7.5, 46.8, 11.1, and 22.2%, respectively. (Kreager-FIRL)
W76-10230

BIOLOGICAL TREATMENT OF WASTE WITH HIGH ASH CONTENT USING A HYDROLYTICALLY ASSISTED EXTENDED AERATION PROCESS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
A. E. Gaudy, Jr., T. S. Manickam, H. Saidi, and M. P. Reddy.
Biotechnology and Bioengineering, Vol. 18, No. 5, p 701-721, May, 1976. 7 fig, 3 tab, 10 ref.

Descriptors: *Waste water treatment, *Biological treatment, *Activated sludge, *Biochemical oxygen demand, *Chemical oxygen demand, *Suspended solids, Aeration, Digestion.
Identifiers: Ash content, Extended aeration.

A modified extended aeration process for biological treatment of wastes, in which autodigestion was aided and controlled by periodic partial hydrolysis of small portions of the recycle sludge, was previously demonstrated to be feasible using an artificial waste containing little suspended organic solids. To test the process for wastes with high organic feed content and ash content, a 1.5 year pilot study was made using hydrolyzed trickling filter sludge. Analyses were performed for chemical oxygen demand (COD), biochemical oxygen demand (BOD), TOC, suspended solids, ammonia nitrogen, organic-nitrogen, and nitrite-nitrogen. Ash contents in the activated sludge were higher, but did not continually increase or adversely affect the efficiency of organic matter removal. They may have enhanced separation in the final clarifier, since there was little trouble in separating mixed liquor at concentrations over 20,000 mg/liter. COD and suspended solids removal and BOD samples indicated that the system provided waste water purification comparable to other activated sludge processes operating on wastes of much lower ash content. The high dissolved inorganic solids concentration in the effluent is apparently amenable to further physical-chemical treatment. Several further treatment processes were investigated. Ion exchange appears to favorably reduce solids, and, while activated carbon adsorption was relatively ineffective in solids removal, it was extremely effective in removing color. (Snyder-FIRL)
W76-10231

DESIGN CRITERIA FOR MICROSCREENING BIOLOGICAL WASTEWATER PLANT EFFLUENTS,
Ewing Engineering Co., Milwaukee, Wis.
L. Ewing.
Water and Sewage Works, Reference number, p R-94-R-96, R-98-R-101, April 30, 1976. 3 fig, 3 tab, 6 ref.

Descriptors: *Screens, *Biological treatment, *Waste water treatment, *Activated sludge, *Tertiary treatment, Physical properties, On-site investigations, Treatment facilities, Equipment, Performance, Evaluation, Solid wastes, Waste treatment, Treatment, Biochemical oxygen demand, *Design criteria.
Identifiers: Microscreens.

Factors affecting the performance of horizontal rotary drum type microscreens used in biological waste water plants are reviewed along with operating and performance data obtained at two activated sludge plants using microscreens. Major variables affecting the removal efficiency of microscreens and/or effluent quality include: biological loading of the upstream process, final clarifier hydraulic loading, flocculation procedures, hydraulic head across screen media, upstream hydraulics, effectiveness of the solids collection system, media aperture, screen peripheral speed, and raw waste water characteristics. Variables affecting screen capacity expressed as gallons/min/ft of width include: type of biological process and loading, screen influent suspended solids concentration, media effective open area, peripheral speed, effectiveness of cleaning system and solids removal system, head across screen media, media aperture, temperature, and diameter or length of submerged arc. Data obtained from an activated sludge facility using a microscreen for tertiary treatment revealed effluent suspended solids and biochemical oxygen demand concentrations of less than 5 mg/liter under normal operating conditions. The screen successfully handled plant effluents with suspended solid concentrations up to 80 mg/liter. (Kreager-FIRL)
W76-10232

SODIUM BICARBONATE DOSES UPGRADE PLANT TO '77 STANDARDS.
Water and Sewage Works, Reference number, p R-64-R65, April 30, 1976.

Descriptors: *Sewage treatment, *Sodium compounds, *Neutralization, *Alkalinity, *Bicarbonates, Evaluation, On-site investigations, Trickling filters, Performance, *Treatment facilities, Biochemical oxygen demand, Chemical properties, Efficiencies, Sludge, Sludge digestion, Methane, Water quality standards.
Identifiers: *Sodium bicarbonate.

Field tests at a gravity flow trickling filter sewage treatment plant were conducted to assess the effect of sodium bicarbonate addition to the process on the level of biochemical oxygen demand. The addition of 4 lb/hr of sodium bicarbonate to the waste stream as it passed through the bar screen reduced the biochemical oxygen demand from 15-25 mg/liter to less than 10 mg/liter, the latter figure being in compliance with the 1977 Environmental Protection Agency standards. This reduction was the result of the buffering capacity of sodium bicarbonate to neutralize the fatty acids in the waste. Tests involving the addition of 100 lb of sodium bicarbonate to the plant's sludge digester each day were also conducted. This addition resulted in the alkalinity being increased from about 1400-1500 mg/liter to as high as 2500 mg/liter, with the pH being maintained between 6.6 and 6.7. This in turn resulted in better solids/liquid separation, a finer particle cake, less odor, and an increase in methane production from 800-900 cu ft/day to 4000 cu ft/day. (Kreager-FIRL)
W76-10233

ANIONIC AND NON-IONIC SURFACTANT BIODEGRADATION IN A PURIFYING PLANT USING ACTIVATING MUDS (BIODEGRADAZIONE DE TENSIOATTIVI ANIONICI E NON-IONICI IN UN IMPIANTO DI TRATTAMENTO A FANGHI ATTIVATI),
Stazione Sperimentale Oli e dei Grassi, Milano (Italy).
For primary bibliographic entry see Field 5A.
W76-10238

EFFECT OF WASTEWATER COMPOSITION AND CELL RESIDENCE TIME ON PHOSPHORUS REMOVAL IN ACTIVATED SLUDGE,
Phillips Petroleum Co., Bartlesville, Okla.
T. R. Stall, and J. H. Sherrard.
Journal Water Pollution Control Federation, Vol. 48, No. 2, p 307-322, February, 1976. 8 fig, 4 tab, 23 ref.

Descriptors: *Waste water treatment, *Biological treatment, *Activated sludge, *Chemical oxygen demand, *Phosphorus, Phosphates, Hydrogen ion concentration, Suspended solids, Microorganisms, Temperature, Analytical techniques.
Identifiers: Cell residence time.

A bench-scale activated sludge unit was operated under closely controlled conditions to study the influence of mean cell residence time and stoichiometric relationships on phosphorus removal. It was operated on a batch basis until the solids concentration reached approximately 1,500 mg/liter, then switched to continuous flow operating conditions. The initial seed of microorganisms was taken from a well-operating experimental activated sludge system. The raw feed solution was tested for chemical oxygen demand, total phosphate phosphorus and pH; the unfiltered effluent for total phosphate-phosphorus, pH, and suspended solids; filtered effluent for COD and soluble phosphate-phosphorus; and the biological reactor for aeration basin ss, total system microorganisms concentration, temperature, and pH. Phosphorus removal efficiencies were higher when mean cell residence time was lower. At any given mean cell residence time, larger COD: phosphorus ratios produced higher phosphorus removal efficiencies. The phosphorus content of the sludge varied between 2.21% and 3.63% on a dry weight basis. Phosphorus removal efficiency and sludge production are directly related. The effective phosphorus removal efficiency is significantly reduced by solids carry-over in the effluent. Biological phosphorus removal may be predicted closely if the cellular phosphorus content and the sludge production are estimated reasonably. Phosphorus may become a limiting nutrient at high COD: phosphorus ratios and low sludge ages, whereas COD is limiting at a high sludge age. (Snyder-FIRL)
W76-10239

FLUCTUATIONS OF THE RUNOFF OF TWO ACTIVATED SLUDGE PLANTS AND ITS CONSEQUENCES FOR THE OBSERVANCE OF LIMIT VALUES (SCHWANKUNGEN DER ABLAEUFE ZWEIER SCHLAMMBELEBUNSANLAGEN UND INRE KONSEQUENZEN FUER DIE EINHALTBARKEIT VON GRENZWERTEN),
H-J. Frenzel, and F. Sarfert.
Gas-und Wasserfach-Wasser/Abwasser, Vol. 117, No. 3, p 123-128, 1976. 10 fig, 6 ref.

Descriptors: *Waste water treatment, *Biological treatment, *Activated sludge, *Biochemical oxygen demand, *Treatment facilities, Potassium compounds, Nitrogen, Phosphates, Runoff.
Identifiers: Dry matter content.

The BOD5 value, the KMnO4 consumption, the total nitrogen content and the phosphate content were measured in the purified effluent from a low-loaded biological waste water treatment plant and from a normally loaded pilot plant in a study on the possibility of observing the limiting values according to Poepel's concept. The BOD5 level, the KMnO4 consumption and the dry matter content were lower in the effluent from the low-leaded treatment plant, while the phosphate content was higher due to the limited mineralization of the activated sludge at the low sludge BOD5 level of about 0.1 kg/kg x day. It was impossible to adopt a limit value which is never exceeded. The compliance with the limit value can be determined by a limited random sampling rather than daily checks. (Takacs-FIRL)
W76-10242

EVALUATION OF THE CIRIA PROTOTYPE MODEL FOR THE DESIGN OF SEWAGE-TREATMENT WORKS,
K. Bowden, R. S. Gale, and D. E. Wright.
Water Pollution Control, Vol. 75, No. 2, p 192-205, 1976. 3 fig, 3 tab, 17 ref.

Descriptors: *Sewage treatment, *Optimization, *Computer programs, *Model studies, *Cost analysis, Waste water treatment, Evaluation, Design criteria, *Treatment facilities.

A prototype computer model for the cost optimization of sewage treatment plant design is presented. Performance relationships for each of the unit processes involved are built into the model; cost data are not incorporated into the model since these vary considerably from site to site and with the degree of inflation. Parameters used for characterizing the process are those used in conventional sewage treatment practice (biochemical oxygen demand, suspended solids, ammonia for liquors, and total solids content and volatile content for sludge). Application of the model is illustrated by an example involving a series of sewage works having different flows but the same series of processes and the same influent and effluent concentrations. (Kreager-FIRL)
W76-10245

CONTRIBUTION TO OPTIMIZING CHEMICAL PRECIPITATION IN UNTREATED WASTE WATER THROUGH CONTROL OF THE ADDED FLOCCULANT QUANTITY (BEITRAG ZUR OPTIMIERUNG CHEMISCHER FAELLUNG IM ROHABWASSER DURCH DIE STEUERUNG DER FAELLMITTELZUGABEMENGE),
H. Overath, and G. Marr.
Gas-und Wasserfach-Wasser/Abwasser, Vol. 117, No. 3, p 109-122, 1976. 15 fig, 5 tab, 42 ref.

Descriptors: *Waste water treatment, *Chemical precipitation, *Flocculation, *Optimization, *Phosphorus, Hydrogen ion concentration, Alkalinity, Electrical conductance, Turbidity.

The influence of different chemical and physical characteristics of untreated municipal waste water on the optimal dosage of flocculant (a by-product from bleaching earth production, a highly acid liquid with Al, Fe, Ca, Mg and Cl ions) was studied in model experiments. The optimal quantity of the flocculant was determined primarily by the phosphorus concentration in the raw waste water. A correlation factor of 0.963 was found for the relationship between phosphorus concentration and the optimal flocculant dose. The correlation factor expressing the relationship between the optimal flocculant dose and the pH value before the flocculant addition is -0.455. A correlation factor of 0.670 was found for the alkalinity. A correlation with the electric conductivity was found to be 0.818. The findings indicate that the electrical conductivity, the standardized alkalinity and turbidity can be used as parameters for the control of the flocculant dosage. (Takacs-FIRL)
W76-10246

VERIFICATION STUDIES OF THE BIOFILM MODEL FOR BACTERIAL SUBSTRATE UTILIZATION,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
K. Williamson, and P. L. McCarty.
Journal Water Pollution Control Federation, Vol. 48, No. 2, p 281-296, February, 1976. 19 fig, 5 tab, 8 ref.

Descriptors: *Biological treatment, *Waste water treatment, *Model studies, *Kinetics, *Aerobic bacteria, Membranes, Diffusion, *Films.
Identifiers: *Biofilm models.

A verification study was performed for a model describing the kinetics of substrate utilization by biofilms. Aerobic, autotrophic, nitrifying bacteria were used as test organisms. Biofilms were made before each experiment by filtering dispersed bacteria onto membrane filters. The biofilm thickness was determined by examining a side view of the biofilm and the support filter with a microscope and a calibrated ocular micrometer. The diffusion reactor consisted of an enclosed Plexiglas cylinder immersed in an outer vessel. The biofilm model accurately predicted the biofilm substrate utilization rate for deep biofilms that are flux and substrate limited by either an electron donor or an electron acceptor. It was also modified to predict accurately the substrate utilization rate for thin biofilms that were flux and substrate limited by the electron donor and for which the substrate concentrations throughout the biofilm were greater than the half-velocity coefficient. A mathematical relationship was determined indicating whether the biofilm will be flux limited by the electron acceptor or the electron donor. Diffusion coefficients for ammonia, nitrate, nitrite, and oxygen through biofilms of nitrifying bacteria of about 80 to 100% of their corresponding values in water were obtained. (Snyder-FIRL)
W76-10247

PERCOLATION TESTS FOR SEPTIC TANK SUITABILITY IN SOUTHERN ARIZONA SOILS,
Arizona Univ., Tuscon. Dept of Soils, Water, and Engineering.
K. A. Barbarick, A. W. Warrick, and D. F. Post.
Journal of Soil and Water Conservation, Vol. 31, No. 3, p 110-112, May-June, 1976. 2 fig, 4 tab, 20 ref.

Descriptors: *Percolation, *Soil tests, *Septic tanks, Testing procedures, *On-site tests, Soil properties, Subsoil, Sands, Clays, Silts, Gravels, Soil types, Soil chemistry, Hydrogen ion concentration, Electrical conductance, *Arizona, Path of pollutants.

Percolation tests for septic tank suitability were conducted in nine southern Arizona soils to determine relationships between the percolation rate and test-hole diameter and to correlate the rates with selected soil parameters. Both a mathematical relationship and a regression analysis were used to relate percolation rate to test-hole geometry. Percent carbonates varied from 1.6% to 7.4%, pH from 7.7 to 8.1, electrical conductivity from 0.1 to 0.4, and EDTA required for the saturation extract from 0.2 ml to 0.7 ml. The theoretically predicted percolation rate of a 10 cm diameter test-hole was 2.5 times that of a 30 cm hole, an estimate which approximated the experimental results. Variability coefficients for percolation rates at each site ranged between 7% and 48%. Percent sand, clay, and silt in the subsoil correlated significantly with percolation rate. Multiple regression analysis showed that percentages of clay, silt, sand, gravel, and carbonates in subsoil; subsoil pH and electrical conductivity; and amount of EDTA required accounted for 62% of the variation in percolation rates. A variance analysis of soil parameters indicated significant differences among the sites for every parameter. (Snyder-FIRL)
W76-10248

RECLAMATION OF A BURNED ANTHRACITE REFUSE BANK WITH MUNICIPAL SLUDGE,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 5E.
W76-10249

GREAT LAKES POLLUTION CLEANUP STAGNATES AS PROBLEMS MOUNT,
For primary bibliographic entry see Field 5G.
W76-10250

TECHNIQUES FOR POWER MEASUREMENT FOR SURFACE AERATOR,
National Environmental Engineering Research Inst., Nagpur (India).
S. N. Kaul, and V. Raman.
Indian Journal of Environmental Health, Vol. 17, No. 3, p 232-237, 1975. 3 fig, 14 ref.

Descriptors: *Aeration, *Electrical properties, *Efficiencies, *Electrical design, Evaluation, Performance, *Waste water treatment, Equipment, Measurement.
Identifiers: *Surface aerator.

A review of techniques used for measuring the power output from surface aerators is presented along with a comparison of two laboratory methods used for power measurements on full scale aerators. Configurations using an induction motor connected to an alternating current source versus those using a direct current generator as the power source were compared, and the latter type was found more suitable for power input/output and efficiency calculations since it was not affected by frequency changes and skin effects associated with the alternating current configuration. The net power consumed by full-scale aerators was calculated by multiplying the output power by the gear efficiency. (Kreager-FIRL)
W76-10251

TREATMENT OF SYNTHETIC URINOUS WASTEWATER USING COMBINED REVERSE OSMOSIS, IMMOBILIZED UREASE, AND ION EXCHANGE SYSTEMS,
Rutgers - The State Univ., New Brunswick, N. J. Coll. of Engineering.
B. Davidson, W. Vieth, S. Wang, and R. Gilmore, Jr.
Available from the National Technical Information Service, Springfield, Va 22161 as AD-A008 947, $6.75 in paper copy, $2.25 in microfiche. 1974, 134 p, 29 fig, 6 tab, 126 ref, 5 append. Prepared for Army Mobility Equipment Research and Development Center, Fort Belvoir, Virginia.

Descriptors: *Waste water treatment, *Sewage treatment, Treatment facilities, *Urine, *Sewage, *Reverse osmosis, *Ion exchange, Membranes, Enzymes, Model studies.
Identifiers: *Urease, Biocatalytic reactors.

A collagen-urease membrane complex of relatively stable enzymatic activity was successfully produced and evaluated for the treatment of urinous waste water. It was evaluated in a spiral wound biocatalytic reactor module integrated into a prototype system containing reverse osmosis and ion exchange processes. A synthetic urinous feed solution containing sodium chloride and urea was used for the evaluation. A transport model based on the assumptions of steady-state, plug-flow, and Michaelis-Menten kinetics and accounting for simultaneous mass transfer and biochemical reaction simulated the performance of the biocatalytic reactor module. The system produced overall urea removals of 75 to 80%. These results are better than can be achieved with a single component system of practical size. Sixty to 80% of the tryptophan was still intact within the matrix in the biocatalytic reactor after intermittent storage and use. An irreversible denaturation of the enzyme must also be occurring in order to account for the decline in enzymatic activity of the collagen-urease membrane complex. The effects of mass transfer were of the same order of magnitude throughout the flow regimes investigated. (Snyder-FIRL)
W76-10254

A PRESENT VALUE-UNIT COST METHODOLOGY FOR EVALUATING WASTE-WATER RECLAMATION AND DIRECT REUSE AT A MILITARY BASE OF OPERATIONS,
Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Sanitary Sciences Div.
V. J. Ciccone.
Available from the National Technical Information Service, Springfield, Va 22161, as AD-A012 175, $3.50 in paper copy, $2.25 in microfiche. December, 1974, 24 p, Report No. 2123, 1 fig, 16 ref.

Descriptors: *Waste water treatment, Analytical techniques, *Water reuse, *Reclamation, *Unit costs, *Cost comparisons, Mathematical models, Computer models, Costs.
Identifiers: Present value-unit cost.

A present value-unit cost (PVUC) methodology was applied to a water supply problem typical for a military base, considering reclamation and direct reuse of treated waste waters. A hierarchy of water use was established, with the highest quality for potable purposes and a lesser quality for non-potable uses. The difference in the calculated unit costs for the alternatives was examined over selected planning horizons, indicating the practicality of a particular quality scheme in the comparison of alternatives. This difference was included in a FORTRAN mathematical model for use on a digital computer. The model selects an optimal water supply system for a military base. The ideas of a dual supply system are incorporated by the reclamation of treated waste waters and the direct reuse of these waters after specified advance treatment. The focus of the model is on the demand for water and alternative methods to satisfy it. The major emphasis is on the role of cost as a determinant. The model essentially consists of a difference equation between the calculated PVUC for each alternative taken over selected planning horizons. A dual water supply system was concluded to be a practical alternative for consideration. The PVUC was a usable measure for evaluating alternatives, and the calculated difference between the PVUC's of two alternatives yielded a worthwhile decision variable, easily calculated with a computer program. The methodology may be applied to existing systems in conjunction with expansion plans or to formulating plans for new military bases. (Snyder-FIRL)
W76-10255

THE DEVELOPMENT OF A SIMPLE WASTE TREATMENT SYSTEM FOR U.S. NAVAL VESSELS,
Denver Research Inst., Denver, Colo.
B. D. Church, L. Griffin, D. Mack, and R. Espinosa.
Available from the National Technical Information Service, Springfield, Va 22161, as AD-A010 233 $4.00 in paper copy, $2.25 in microfiche. Final Report, Office of Naval Research, 1975, 43 p, 11 fig, 6 tab, 14 ref.

Descriptors: *Waste water treatment, *Sewage treatment, *Biological treatment, *Treatment facilities, *Chemical oxygen demand, *Sewage, Fermentation, Sludge, Sludge digestion, Organic wastes.

An apparatus was developed in which shipboard wastes containing garbage, sanitary waste, and small amounts of crankcase oil was successfully digested by continuous fermentation. An initial chemical oxygen demand (COD) over 1000 mg/liter decreased to under 100 mg/liter in 6 hr.

The process has potential advantages for scale-up for shipboard waste treatment. A limiting nitrogen level in the raw waste seriously restricted sludge development and waste material oxidation. Adding 0.05% heavy corn steep liquor overcame this problem. The best microbial sludge mass with regard to waste digestion treatment time and floc settling time, a natural enriched mass, developed from the wastes themselves. (Snyder-FIRL)
W76-10256

SYSTEM FOR TOTAL DIRECT RECYCLE OF SECONDARY MUNICIPAL WASTEWATER, VOL I -- DESIGN CONCEPTS,
Houston Research, Inc., Tex.
C. E. Mauk, S. L. Gandhi, and R. W. Legan.
Available from the National Technical Information Service, Springfield, Va 22161, as AD/A-011 938, $6.75 in paper copy, $2.25 in microfiche. Report AFWL-TR-7 4-235, Vol. I June 1975, 157 p, 17 tab, 28 ref.

Descriptors: *Waste water treatment, *Sewage treatment, *Treatment facilities, Effluents, *Recycling, *Water reuse, Design, Potable water, Tertiary treatment, Reclaimed water, Recirculated water.

The conversion of secondary municipal effluent from an existing conventional waste water treatment facility to a quality suitable for potable use was studied. Over 800 papers and reports on all advanced waste water treatment processes were acquired in a comprehensive literature survey. The important processes were summarized and evaluated. A set of potable water quality criteria parameters was defined for closed loop water reuse. Mathematical performance and cost models were compiled for the individual processes. Both microscreening and multimedia filtration were included for suspended solids removal. Air stripping of ammonia ion exchange by clinoptilolite, and nitrification/denitrification were included for nitrogen removal. Although many municipal plants may already have a lime treatment step or no phosphate problem, phosphate removal by lime treatment was included. Regeneration and non-regeneration of carbon were both considered for the removal of dissolved organic material with activated carbon. Reverse osmosis and ion exchange were included, but not electrodialysis, due to operational problems and the lack of large scale, long term data. While ozone is expected to be more effective and economical for disinfection than chlorine, adding ozone to drinking water is not currently practiced in the United States, and authorities favor chlorine because of its long term residual. Evaporation was used for brine disposal because nonevaporative processes are not generally applicable and may not be allowed in the future. Incineration and nonincineration options were included for sludge disposal. The 14 processes were included in a FORTRAN computer program for performing design calculations of optimal combinations of the processes. (Snyder-FIRL)
W76-10257

LSW-500 DISPOSAL OF AIR FORCE LIQUID WASTES,
Combustion Power Co., Inc., Menlo Park, Calif.
For primary bibliographic entry see Field 5E.
W76-10258

WATER REUSE IN THE UNITED STATES,
Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio.
B. H. Pringle.
Available from the National Technical Information Service, Springfield, Va 22161, as AD-A011-856, $3.50 in paper copy, $2.25 in microfiche. EPA Report, December 1974, 89 p 7 ref.

Descriptors: *Waste water treatment, *Sewage treatment, *Water reuse, *Sewerage, *Treatment facilities, *Recycling, Pathology, Toxicity, Public health, Water pollution effects, Waste water disposal, United States.
Identifiers: Environmental toxicology.

The demand for water and the level of indirect water reuse in the United States have been increasing. There is also increased interest in direct reuse of treated water for domestic supply. Direct reuse is accomplished by recycling waste treatment plant effluents directly to the water treatment plant; indirect reuse involves the discharge of effluents to bodies or watersheds where it becomes available for use again. Neither the Environmental Protection Agency nor the American Water Works Association approved direct reuse in the early 1970's. Current drinking water standards do not consider the possible toxic elements and compounds likely to be found in waste water. Some of the key health factors to be considered include viruses, bacteria, other microorganisms, chemicals, and the reliability of plant operation. The kind of supply many advocate for reuse with no additional treatment could produce a 30% viral infection rate, and the infected individuals could then infect others. Bacteria, protozoa, and helminthes could also be spread by direct reuse. Most sewage treatment processes remove little of the chemicals disposed of in sewers. Waste water and water treatment plants are not sufficiently reliable. Failsafe treatment operations with monitoring and control should be provided. (Snyder-FIRL)
W76-10260

THIURAM POLYSULFIDE HEAVY METAL REMOVER,
Sagami Chemical Research Center, Tokyo (Japan). (Assignee).
T. Fujisawa, M. Ambe, N. Kobayashi, A. Osawa, and K. Shimizu.
U.S. Patent No. 3,951,790, 7 p, 13 tab, 13 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1342, April 20, 1976.

Descriptors: *Patents, *Water pollution, *Mercury, *Heavy metals, *Waste water treatment, Water pollution treatment, Water quality control, Water pollution sources, Separation techniques, Chemical reactions, Selectivity.

A polymeric compound having thiuram mono- or poly-sulfide linkage shows noteworthy property for removing and collecting heavy metals, especially mercury in any form, from the environment. The compound shows ability to selectively recover some kinds of heavy metals by the selection of appropriate conditions. The heavy metal removers can be used effectively to remove heavy metals in wide pH conditions. The affinities of heavy metals with the compound can vary with the change of conditions and selective removal of specified heavy metals can be achieved by selection of appropriate conditions. However, the removers cannot react with an alkali metal contained in the solution. The reaction products of the heavy metal removers and the heavy metals are, in general, insoluble or sparingly soluble in an aqueous solution, and therefore, the removers can easily be separated and recovered from the treated solution by a conventional procedure, such as filtration, settling, centrifuge and the like. The adoption of a closed system known in the art, such as column system, fixed bed system or fluidized bed system, is preferred. (Sinha - OEIS)
W76-10466

METHOD FOR TREATING FOULED WATER,
Mitsubishi Gas Chemical Co., Ltd., Tokyo (Japan). (Assignee).
C. Y. Huang, N. Takashina, and T. Nishimura.
U.S. Patent No. 3,951,791, 5 p, 5 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1342, April 20, 1976.

Descriptors: *Patents, *Water treatment, *Water pollution treatment, *Waste water treatment, Chemical wastes, Flocculation, Chemical reactions.
Identifiers: Anionic latexes, Anionic resin emulsions.

A method is described for flocculating solid particles suspended in fouled water containing anionic latexes or anionic resin emulsions which comprises adding to the fouled water 0.1 to 15 parts by weight, based on 100 parts of the suspended solid in the fouled water, of a cationic aqueous dispersion of a copolymer having a quaternary ammonium salt form or an inorganic or organic acid salt form, which is obtained by the emulsion polymerization in the presence of a cationic surfactant. (Sinha - OEIS)
W76-10467

FLOCCULATION OF SUSPENDED SOLIDS,
GAF Corp., New York. (Assignee).
J. L. Azorlosa, and E. P. Williams.
U.S. Patent No. 3,951,792, 4 p, 1 fig, 3 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1343, April 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Industrial wastes, *Chemical wastes, Water pollution treatment, Water pollution control, Water quality control, Flocculation, Suspended solids, Separation techniques, Mineral industry.
Identifiers: Synergistic effect.

The flocculation of solids suspended in an aqueous phase is enhanced by the addition of a flocculation amount of a novel flocculating composition consisting essentially of a blend of from about 2 to about 3 parts by weight of polyvinyl pyrrolidone having a K-value of from about 80 to about 140 and about 1 part by weight of polyethylene imine having a viscosity in 5% aqueous solution at 25 deg C of from about 20 to about 5,000 centipoises. The blend can be added to the aqueous phase either in dry form or as an aqueous solution. The flocculating agents prepared in accordance with this invention may be employed in the flocculation or anionic colloidal dispersions in aqueous systems. They are excellent for precipitating anionic dispersed latices natural and synthetic, sewage for separating sewer sludges, for separating sludges from industrial operations, and in its precipitation of colloidal dispersions of all types having an anionic charge. They are of particular interest in many areas of mineral ore recovery. (Sinha - OEIS)
W76-10468

PROCESS AND APPARATUS FOR TREATING FATTY WASTE WATER,
Alar Engineering Corp., Chicago, Ill. (Assignee).
A. J. Doncer, and H. R. White.
U.S. Patent No. 3,951,795, 12 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1343, April 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Water purification, *Water pollution treatment, Water pollution control, Water quality control, *Lipids, Food-processing industry, Filtration, Sludge disposal, Settling basins, Calcium hydroxide, Chemical reactions.
Identifiers: Grease pits.

The invention relates to a system for treatment of fat containing waste waters produced during normal industrial and commercial scale food-processing operations, including equipment cleanup of processing operations. The system requires no modifications to present plant operations and procedures. The waste water cleanup system may be housed in an integral building structure and placed on top of a grease pit and settling basin, minimizing space requirements and installation costs. The chemical addition system, controls and other components may also be housed in this structure. After filtration, the dry

sludge is conveniently conveyed outside the structure into commercial dry waste disposal containers. Waste water is first mixed with a ferric salt aqueous solution until a pH in the range from about 3 to 5 is achieved. The resulting mixture is then mixed with calcium hydroxide until a pH in the range from about 7 to 8 is achieved. After calcium hydroxide treatment, the resulting so-chemically treated waste waters are maintained in a hold zone which serves multiple functions. Finally the so-chemically treated system is subjected to filtration using a rotary vacuum filter. The product filtered water is characteristically at least sufficiently high in its quality to meet all known governmental standards for water-sewering purposes. (Sinha-OEIS)
W76-10471

PHOTOOXIDATIVE DESTRUCTION OF ORGANIC WASTES,
Charles F. Kettering Foundation, Dayton, Ohio. (Assignee).
G. R. Seely.
U.S. Patent No. 3,951,797, 7 p, 3 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1344, April 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Chemical wastes, *Water pollution treatment, Water pollution control, Water quality control, *Oxidation, Dyes, Organic compounds, Phenols, Catalysts.
Identifiers: *Photooxidation, Alginates.

A feasible method of promoting photooxidation of organic waste materials, including phenolic compounds is provided. The method involves the use of gelled metal alginate particles. The particles are stained with an appropriate sensitizing dye which will photocatalytically generate singlet oxygen in the presence of sunlight or artificial light for effective destruction of the oxidizable pollutants contained in the organic wastes. Most organic waste molecules are not destroyed by direct absorption of visible light, but when oxygen is excited to a singlet state, it becomes a strong oxidizing agent capable of oxidizing many ordinarily refractory organic compounds. This invention utilizes those known principles in providing a means to effectively oxidize polluting organic compounds. In addition to providing the known sensitizing function of homogeneous dye systems, the dyestained alginate particles present a heterogeneous phase in which there is no need to separate the dye from the water treated as occurs when a homogeneous dye systems is used. In addition, the particles do not introduce a new toxic material into the environment since alginate is known to be both non-toxic and biodegradable. Likewise, the dyes used are not notably toxic, and are slowly degraded under conditions of use. (Sinha-OEIS)
W76-10472

FILTRATION PROCESS,
Commonwealth Scientific and Industrial Research Organization, Campbell (Australia); and Imperial Chemical Industries of Australia, Campbell; and New Zealand Ltd., Campbell (Australia). (Assignees).
D. E. Weiss, and H. A. J. Battaerd.
U.S. Patent No. 3,951,799, 12 p, 1 fig, 7 tab, 10 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1345, April 20, 1976.

Descriptors: *Patents, *Separation techniques, Oil spills, *Oil pollution, *Wettability, Absorption, *Waste water treatment, Polymers, Magnetic studies, Cooling water, Filtration.
Identifiers: *Phase separation, *Ferromagnetic polymers, Oil slicks.

A process of phase separation comprises the treatment of a mixture of phases with ferromagnetic material in particulate or granular form whereby at least part of one phase of the mixture is absorbed or collected into or onto the particulate or granular material and the separation by magnetic means of the particulate material together with the absorbed or collected portion of the mixture, from the remainder of the mixture. It is preferred to use a synthetic polymer comprising ferromagnetic material. One class of suitable polymers for use in a given multi-phase mixture in which at least one of the phases is a liquid are those which are preferentially wetted by a liquid phase of the mixture. The chemical constitution of the polymers is not critical except insofar as the polymer should have adequate insolubility as well as mechanical and chemical stability in the mixture; the main criterion for selection is wettability. A second class of suitable polymers are those which will preferentially absorb one of the phases of the mixture. Suitable polymers are those which will swell in good solvents for the polymer and will not do so in non-solvents. The efficiency of the process also depends on the size, size distribution and shape of the polymer particles. Relatively coarse particles are best for certain applications such as removing oil slicks from the surface of the sea especially in windy weather. For use as filter aids smaller particles are preferred. The invention is also of use in a liquid/gas phase separation problem encountered in cooling towers. (Sinha-OEIS)
W76-10473

METHOD OF STORING SLUDGE RECOVERED FROM THE HOT WATER EXTRACTION OF BITUMEN FROM TAR SANDS,
Great Canadian Oil Sands Limited, Toronto (Ontario). (Assignee).
J. E. Ashton, and J. Davitt.
U.S. Patent No. 3,951,800, 5 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1345, April 20, 1976.

Descriptors: *Patents, *Sludge treatment, *Sludge disposal, *Waste storage, Water pollution control, Water quality control, Bituminous materials, Flocculation, Storage, Settling basins, *Waste water treatment.
Identifiers: Tar sands.

A method for storing bitumen-containing sludge formed in a retention pond used to store effluent discharge recovered from the hot water extraction of bitumen from tar sands also provides for outdoor open storage of sludge in a manner which does not negatively affect the local environment. Sludge which has formed in a quiescent retention pond used for storing effluent discharge is transferred to a storage area comprised of a receiving zone and a storage zone. The receiving zone can be described as a receiving well or tank in which the sludge is first deposited. This receiving zone communicates with the generally larger open storage zone via subsurface openings in a barrier which separates the closed receiving zone from the general storage zone. The open storage zone contains a surface layer of substantially unpolluted water. When entering the storage zone from the receiving well, the sludge displaces the freshwater layer in the storage zone upwardly because of the higher density of the sludge. Thus the sludge storage zone is composed of two layers, an upper surface layer of uncontaminated water and a lower subsurface layer of sludge. By treating the unpolluted surface water layer with a flocculating agent, the intrusion of sludge contamination can be substantially suppressed or diminished. The flocculating agents can be added to the surface water before, during, or after the sludge layer has been introduced into the storage zone. (Sinha-OEIS)
W76-10474

CLARIFIER APPARATUS,
Ecodyne Corp., Lincolnshire, Ill. (Assignee).
For primary bibliographic entry see Field 5F.
W76-10479

FILTER PRESS,
Gebrueder Bellmer K.G. Maschinenfabrik, Niefern (West Germany). (Assignee).
U. Kollmar.
U. S. Patent No. 3,951,809, 5 p, 2 fig, 13 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1348, April 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Water pollution control, Water quality control, Sludge, Sludge treatment, Filtration, Filters.
Identifiers: Filter presses.

A web filter press is described in which the endless filter webs, after leaving the tapered filtering space, are guided around a so-called dandy roll or pulp roller, whereupon the two webs are guided through several S-shaped runs in which the webs may be deflected over an angle of 90 deg or more. One or both of the endless filter webs include run portions in which they pass over suction boxes so that the suspension is subjected to the suction effect of a negative pressure. Continuously operating web filter presses for the removal of the liquid component from suspensions, such as fiber-containing slurries or sludge are also particularly suitable for the removal of the water from the settling sludge obtained in sewage treatment facilities. (Sinha - OEIS)
W76-10481

MODULAR CONTAINER,
Almag Pollution Control Corp., Baltimore, Md. (Assignee).
A. J. Casolo, and H. Handler.
U. S. Patent No. 3,951,811, 5 p, 4 fig, 17 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1349, April 20, 1976.

Descriptors: *Patents, *Water purification, *Water treatment, *Water pollution treatment, Water pollution control, Water quality control, Filtration, Ion exchange, Resins, *Waste water treatment.
Identifiers: Modular containers, Particulate material.

A modular container includes a housing frame containing particulate material through which contaminated liquid is passed for purposes of purification. The container provides a mechanism whereby contaminated liquid may be introduced, passed through the particulate material and transported out of the container in a somewhat more purified state. The modular container can be utilized to hold particulate material in filtration process systems. In such cases particulate material may be sand, anthracite, or an adsorbing material such as activated carbon. Also the container can be used to maintain particulate material in ion exchange reactions where a number of containers may be arranged in some continuous flow path to provide purification of liquids as a function of ion exchange resinous materials through which the contaminated liquid passes. The invention permits insertion and removal of particulate material without requiring removal of the container from its location in an operating system, or it can be removed from a system and easily replaced to provide decreased ion-exchange system non-operating time. (Sinha - OEIS)
W76-10483

COMPOSITE SEMIPERMEABLE MEMBRANES MADE FROM POLYETHYLENIMINE,
Universal Oil Products Company, Des Plaines, Ill. (Assignee).
For primary bibliographic entry see Field 3A.
W76-10485

CLARIFICATION TANK,
Burmah Oil and Gas Co., Houston, Tex. (Assignee).
A. H. Bascope, and E. H. Grizzard.
U.S. Patent No. 3,951,816, 4 p, 5 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1350-1351, April 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, Oil industry, *Oil pollution, *Water purification, Flotation, Water pollution treatment, Water pollution control, Water quality contrl, Weirs.

In oilfield water flooding operations, which are commonly used as secondary recovery method for crude oil production, oil is produced by injection of water into an oil bearing sand formation to displace the oil and water in the sand formation towards adjacent wells where it is brought to the surface. The oil thus produced is an oil-water mixture containing about 60 to 70% water, and the oil in such production mixtures is normally separated from the water by physical separation means such as settling tanks. The water separated from this mixture still contains on the order of 50 to 500 ppm oil. Consequently, this waste water is subjected to further clan-up operations to remove the residual oil prior to final disposal of the waste water or reusing it in an industrial application. According to the present clarification tank design, water is removed from the cell or tank adjacent the bottom, through a series of pick-up tubes which are connected to a central collection column or plenum chamber which is connected to an external vertical riser through which the clarified water is removed from the central collection tubes. The upper end of the vertical riser is provided with a weir assembly which is vertically adjustable so that the liquid level in the clarification tank can be accurately controlled by adjustment of a single weir. The weir device at the upper end of the riser is a four-sided enclosure positioned over the top of the riser tube to discharge water on all four sides into a weir box which is connected to an outlet tube. Sand and other solid particles settle to the bottom and are withdrawn. (Sinha - OEIS)
W76-10486

CHEVRON CLARIFIER,
M. Bosnjak.
U.S. Patent No. 3,951,818, 7 p, 6 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1351, April 20, 1976.

Descriptors: *Patents, *Water purification, *Waste water treatment, *Separation techniques, Industrial wastes, Food processing industry, Water pollution treatment, Water pollution control, Water quality control, Equipment.
Identifiers: Gravity separation, Sugar beet refineries.

The clarifier provides a vessel having a separation portion within which a number of separation elements are retained in at least one pair of vertical columns. Each separation element has a uniform cross section in the direction of fluid flow which is achieved by the construction of the separation element. Each element generally has a vertically downward extending portion or wing and a downward and outward wing joined at an apex at a predetermined angle. Both wings are generally rectangular in shape. A predetermined number of separation apertures are provided near the apex. Each pair of vertical columns of separation elements is arranged such that the downward wings provide a vertically extending collecting channel through which the clarified liquid will flow. As the substance of heavier density settles toward the bottom of the vessel, a gradient of specific gravity is established between the top and bottom of the vessel, with the top having a lesser specific gravity. As the substance of heavier density settles the specific gravity gradient causes a buoyant or generally upward flow of the liquid as its specific gravity decreases. The upward-flowing liquid encounters the downward and outward wings of the separation filter elements and the buoyancy forces the liquid toward the separation apertures to the collecting channel. The separation apertures restrict the flow into the collecting channel to a slow laminar flow to insure that the particles of heavier density will settle downward against the similar outward and downward jutting wings of the separation element. (Sinha-OEIS)
W76-10488

PHOSPHORUS REMOVAL DEMONSTRATION STUDIES AT C.F.B. TRENTON, PHASE II,
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.
W. E. Stepko.
Technology Development Report EPS 4-WP-76-4, Environmental Protection Service April, 1976, 33 p, 9 fig, 8 tab, 11 ref, append.

Descriptors: *Sludge treatment, *Treatment facilities, Sludge, *Waste water treatment, Sewers, Sewage treatment, Sediments, Phosphorus, *Canada.
Identifiers: *Phosphorus removal, Soluble phosphorus, Alum addition.

Full scale phosphorus removal studies, employing alum addition to an activated sludge treatment plant, were conducted at C.F.B. Trenton. Treatment plant performance with respect to total phosphorus removals was closely monitored under a number of alum addition levels and several different alum addition schemes. The optimum alum dosage for phosphorus removal was 1.3 mg/l as Al and the most effective addition scheme was a continuous 24 hour addition to the exit end of the aeration basins. This procedure resulted in a 57% reduction in the alum requirement for phosphorus removal (effluent phosphorus level less than 1 mg/l) and lowered the annual chemical costs from $5,800 to $2,500. Removal of soluble phosphorus above stoichiometric amounts of aluminum was observed during periods of reduced alum dosages. This additional removal is thought to be caused by the strong phosphate binding properties of the recycled alum sludge. The comparison of jar test predictions with plant scale results revealed that the jar test overestimated the optimum alum dosage for phosphorus removal by 500 percent. The choice of a prime precipitant and the determination of the optimum precipitant dosage should be based on plant scale studies rather than jar test predictions. (See also W75-09416) (Environment Canada)
W76-10490

EFFLUENT POLISHING BY FILTRATION THROUGH ACTIVATED ALUMINA, VOLUME I.
Pollutech Pollution Advisory Services Ltd., Oakville, (Ontario).
Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report No. 39, Training and Technology Transfer Division (Water), Environmental Protection Service, Environment Canada, Ottawa, Canada, April, 1976, 60 p, 13 fig, 14 tab, 10 ref, append. 73-5-4.

Descriptors: *Filtration, *Waste water treatment, Effluents, Phosphorus, *Efficiencies, Water pollution, Great Lakes, Water quality, Sewage, Nutrients, Economics, *Treatment facilities, Canada.
Identifiers: *Effluent polishing, *Activated alumina columns, Oakville Water Pollution Control Plant(Ontario), Alum treatment, *Phosphorus removal.

The effluent from the Oakville Water Pollution Control Plant was treated with alum to reduce the phosphorus concentration to 1 or 2 mg/l. This pretreated effluent was further polished in activated alumina columns. The phosphorus concentration in the polished effluent depended on the flowrate and the feed phosphorus concentration. Levels of 0.1 mg P/l or less were obtained by this process for appreciable periods. The performance of activated alumina was restored by regeneration with sodium hydroxide after the alumina had been exhausted. This process was estimated to be more economical than alum treatment alone if the desired concentration of phosphorus in the polished effluent was less than 0.5 mg/l. (Environment Canada)
W76-10491

ASSESSMENT OF POLYELECTROLYTES FOR PHOSPHORUS REMOVAL,
McMaster University, Hamilton (Ontario). Dept. of Chemical Engineering.
A. Benedek, A. E. Hameilec, J. J. Bancsi, and T. Ishige.
Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report No. 37, Training, Technology Transfer Division (Water), Environmental Protection Service, March, 1976, 227 p, 196 fig, 12 tab, 50 ref, 3 append. 72-5-6.

Descriptors: *Polyelectrolytes, Water quality, Great Lakes, *Waste water treatment, Domestic wastes, Surface waters, Effluents, Flocculation, Sediments, Phosphorus, *Chemical precipitation, *Coagulation.
Identifiers: *Phosphorus removal.

A simple batch settling test has been developed to examine the process effectiveness of polyelectrolytes. The conditions for polyelectrolyte testing have been optimized and a theoretical data interpretation technique has been developed to permit the extrapolation of batch data to continuous clarifiers. The shear and chemical degradation of solid polyelectrolyte during dissolution in water has been studied. Serious degradation and loss of effectiveness were noted under high shear, in the presence of ferrous ion, and with long term storage. Polyelectrolyte application in phosphorus removal is expected to occur in conjunction with 'coagulant precipitants' such as alum, ferric chloride and lime. Thus, before assessing the effect of polyelectrolytes, the residual settled phosphorus concentration and the settling rate resulting from the addition of these three coagulant precipitants were studied by themselves in model phosphate solutions as a function of phosphate type, pH and coagulant precipitant dosage. The addition of polyelectrolytes slightly increased the removal of residual phosphorus and dramatically increased settling rates in the model solution systems. With polyelectrolytes, satisfactory performance is anticipated over a much wider pH range. The results of a full scale study indicated agreement within 40% between laboratory predictions and full scale removals in the alum domestic wastewater polyelectrolyte system. (Environment Canada)
W76-10492

HARVEST OF BIOLOGICAL PRODUCTION AS A MEANS OF IMPROVING EFFLUENTS FORM SEWAGE LAGOONS,
For primary bibliographic entry see Field 5G.
W76-10500

5E. Ultimate Disposal Of Wastes

USE OF HIGH LEVEL RADIATION IN WASTE TREATMENT--STATUS AND PROSPECTS,
International Atomic Energy Agency, Vienna (Austria). Div. of Life Sciences.
For primary bibliographic entry see Field 5D.
W76-10010

PREDICTING THE WATER POLLUTION POTENTIAL OF PROPOSED SANITARY LANDFILLS PART I: SANITARY LANDFILL LEACHATE...WHAT IT IS,
Indiana Univ., Indianapolis. School of Medicine.
For primary bibliographic entry see Field 5B.
W76-10013

PREDICTING THE WATER POLLUTION POTENTIAL OF PROPOSED SANITARY LANDFILLS PART II: AN INDEX OF THE WATER POLLUTION POTENTIAL OF SANITARY LANDFILLS,
Indiana Univ., Indianapolis. School of Medicine.
For primary bibliographic entry see Field 5B.
W76-10014

POLLUTION OF GROUNDWATER BY LANDFILLS (POLLUTION DE L'EAU SOUTERRAINE PAR LES DECHARGES),
For primary bibliographic entry see Field 5B.
W76-10016

SHORT-TERM REGULATION OF BOD UPSETS IN AN ESTUARY,
Delaware Univ., Newark, Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5G.
W76-10020

MATHEMATICAL MODEL SIMPLIFIES DESIGN OF SLUDGE DRYING BEDS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 5D.
W76-10035

ASSESSMENT OF THE MAXIMUM CONCENTRATION OF HEAVY METALS IN CRUDE SEWAGE WHICH WILL NOT INHIBIT THE ANAEROBIC DIGESTION OF SLUDGE,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 5D.
W76-10040

GROUND-WATER POLLUTION PROBLEMS IN THE NORTHWESTERN UNITED STATES,
Robert S. Kerr Environmental Research Lab., Ada, Okla.
For primary bibliographic entry see Field 5B.
W76-10083

HYDROGEOLOGIC AND OTHER CONSIDERATIONS RELATED TO THE SELECTION OF SANITARY-LANDFILL SITES IN OHIO,
Ohio Dept. of Natural Resources, Columbus. Regional Geology Section.
For primary bibliographic entry see Field 5D.
W76-10084

EFFECTS OF A LANDFILL ON GROUNDWATER QUALITY,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 5B.
W76-10137

WASTE WATER TREATMENT.
Westinghouse Electric Corp., Melbourne (Australia).
For primary bibliographic entry see Field 5D.
W76-10202

TREATMENT AND DISPOSAL OF SEWAGE SLUDGE,
Sterling Drug Inc., New York. (Assignee).
For primary bibliographic entry see Field 5D.
W76-10204

WHAT TO DO WITH SEWAGE SLUDGE.
For primary bibliographic entry see Field 5D.
W76-10210

FOUR-MODE TREATMENT PLANT WILL GENERATE SODIUM HYPOCHLORITE ONSITE.
For primary bibliographic entry see Field 5D.
W76-10213

USE OF THE EARTH'S CRUST FOR TREATMENT OR STORAGE OF SEWAGE EFFLUENT AND OTHER WASTE FLUIDS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 5D.
W76-10216

DISPOSAL OF SEWAGE FROM COASTAL TOWNS: THE CASE FOR SEA OUTFALLS,
Taylor (John) and Sons, London (England).
J. T. Calvert.
Water Pollution Control, Vol. 75, No. 2, p 153-161, 1976. 6 ref.

Descriptors: *Sewage effluents, *Sewage disposal, *Sewage, *Outlets, *Oceans, Biological properties, Biochemical oxygen demand, Chemical properties, *Outfall sewers.

A case is made for the disposal of sewage from coastal towns via sea outfalls. The case for direct sewage discharge is based on observations of natural purification. When sewage is diluted 100 times with clean seawater, it is indistinguishable from fully treated secondary effluent in terms of bacteriological properties and is superior in quality in terms of suspended solids and biochemical oxygen demand. Subsequent to the dilution, the natural chemical and biological processes of purification occur such that no change in the character and composition of the sea can be detected. Other reasons for favoring direct discharge involve land use requirements for treatment facilities and the costs involved. Direct sewage discharge to the sea also eliminates sludge treatment problems. Exceptions to the above approach which might favor some form of treatment include cases where toxic materials are being discharged, problems involving visible solids, and coastal areas where currents are unfavorable. (Kreager-FIRL)
W76-10224

THE DISPOSAL OF SEWAGE FROM COASTAL TOWNS: THE CASE FOR TREATMENT,
For primary bibliographic entry see Field 5D.
W76-10225

IMPROVING THE FUEL VALUE OF SEWAGE SLUDGE,
Municipal Environmental Research Lab., Cincinnati, Ohio.
S. W. Hathaway, and R. A. Olexsey.
News of Environmental Research in Cincinnati, October 31, 1975. 4 p, 3 fig, 2 tab, 8 ref.

Descriptors: *Sewage sludge, *Fuels, *Costs, *Incineration, *Sludge disposal, Ultimate disposal, Dewatering, Sludge treatment.

The cost of auxiliary fuel is an increasingly crucial component of the cost of incinerating municipal sewage sludge. Auxiliary fuel is needed because, even after dewatering, more heat is required to evaporate the entrained water than the sludge solids can provide. Sludge volatility also affects the combustibility of the sludge cake. Less expensive alternative auxiliary fuels are being considered, including coal, municipal refuse, wood chips, and paper products. The use of incinerator ash for sludge conditioning does not remove the need for auxiliary fuels, because the ash must be heated and has no beneficial heat value. Sewage sludge is very compressible, and the compressed floc particles hinder dewatering by making the filter medium less porous. Sludge treatment with an incompressible substance is beneficial because it reduces this effect. Granulated coal with a maximum particle size of 9.5 mm, was added to liquid sludge in dosages ranging from 0.2 to 1.0 kg coal/kg dry sludge solids. When coal dosage was above 0.3 kg coal/kg sludge solids, the combustion of the sludge cake provided sufficient energy to supply the heat needed for incineration. The addition of coal in this particle size range did not produce a startling increase in filter yield. Results from a pilot plant show that without polymer, coal addition does not affect the net yield of sludge solids, but that the addition of polymer significantly increases yield. The cost for coal addition is estimated at $10/metric ton dry sludge solids. The cost of oil as a supplementary fuel is estimated at $17.50/metric ton of dry solids. Coal cannot, in itself, serve as a complete conditioning agent. (Snyder-FIRL)
W76-10234

RECLAMATION OF A BURNED ANTHRACITE REFUSE BANK WITH MUNICIPAL SLUDGE,
Pennsylvania State Univ., University Park. School of Forest Resources.
W. E. Sopper, L. T. Kardos, and B. R. Edgerton.
Compost Science, Vol. 17, No. 2, p 12-19, March-April, 1976. 7 tab.

Descriptors: *Sludge disposal, *Land reclamation, *Fertilization, *Application methods, *Sewage effluents, Irrigation, Vegetation establishment, Trees, Grasses, Legumes, Crops, *Municipal wastes.
Identifiers: Land application.

The use of municipal effluent and sludge to fertilize a burned anthracite refuse bank was studied. A burned anthracite refuse bank was divided into three plots, one of which was not irrigated, one irrigated with effluent, and one irrigated with fresh water. Different sludge application rates were used on different parts of each plot. Ten species of trees, five species of grasses, and five species of legumes were planted in the plots. It was shown that heat-dried sludge, municipal sewage effluent, or a combination may successfully revegetate burned anthracite refuse banks. Irrigation with only fresh water was helpful in establishing seeded legumes, but grasses responded more strongly when sludge was also applied. More tree seedlings survived at the lower rates of sludge application. However, the seedlings that survived showed greater height growth at higher application rates. The hardwood trees, especially hybrid poplar and black locust, had greater potential to revegetate burned refuse banks than the conifers. All of the hardwoods had better survival rates than the best conifers. The species with the highest survival rate was black locust. After one season, black locust and hybrid poplar had the greatest height growth. Hardwoods also grow best with a herbaceous cover. The fast growing legumes and grasses quickly overtop and suppress the slowly growing conifers. The best overall sludge application rate was 34 tons/acre in terms of growth of herbaceous vegetation. Eighteen tons/acre was second best for establishing herbaceous vegetation. Grasses were better suited for revegetation than legumes, which responded poorly under competition. (Snyder-FIRL)
W76-10249

SOFTENING AND COAGULATION SLUDGE-DISPOSAL FOR A SURFACE WATER SUPPLY,
Stilson (Alden E.) and Associates, Columbus, Ohio.
For primary bibliographic entry see Field 5F.
W76-10252

THE FATE OF POLLUTANTS IN SUBSURFACE ENVIRONMENTS,
Weston (Roy F.), Inc., West Chester, Pa.
For primary bibliographic entry see Field 5B.
W76-10253

LSW-500 DISPOSAL OF AIR FORCE LIQUID WASTES,
Combustion Power Co., Inc., Menlo Park, Calif.
Available from the National Technical Information Service, Springfield, Va 22161, as AD-A010 429, $6.00 in paper copy, $2.25 in microfiche. Report AFWL-TR-74-70, April 1975, 137 p, 19 fig, 14 tab, 3 ref, 3 append.

Descriptors: *Treatment facilities, *Sewage sludge, Civil engineering, *Incineration, *Environmental engineering, Sludge disposal, Solid wastes, Smoke, Ultimate disposal, Liquid wastes, Oil wastes, Herbicides.

Identifiers: *Fluidized bed incineration, Orange herbicide.

Thermal degradation of liquid wastes in a fluidized bed incineration system was investigated. The wastes studied included aircraft washrack waste; paint stripping waste; herbicide orange; petroleum, oil, and lubricant waste (POL); municipal garbage; and sewage sludge. Of these, POL wastes, herbicide orange, a portion of the paint stripping waste, and municipal garbage were identified as fuels, with enough heat energy to maintain the fluidized bed at operating temperature. Use of the fluidized bed incinerator to dispose of selected wastes was successful. POL and municipal wastes can be used without additional fuel to dispose of aircraft washrack waste, paint stripping wastes, and sewage sludge. Liquid waste fuels were injected in the lower 6 inches of the fluidized bed using the existing oil guns. Other liquid wastes were injected using the existing feed locations just above and below the secondary bed. Non-fuel liquid wastes could be disposed of at a rate of 148 gal/hr in the test system. Existing exhaust emission standards were met in all areas except particulate matter loading. A dry scrubber is recommended for use with such systems. Herbicide orange can be satisfactorily disposed of providing emission control can be maintained. (Snyder-FIRL)
W76-10258

WATER REUSE IN THE UNITED STATES,
Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio.
For primary bibliographic entry see Field 5D.
W76-10260

POLLUTION-FREE WELL CUTTINGS DISPOSAL APPARATUS,
NL Industries, Inc., New York. (Assignee).
For primary bibliographic entry see Field 5G.
W76-10464

METHOD OF STORING SLUDGE RECOVERED FROM THE HOT WATER EXTRACTION OF BITUMEN FROM TAR SANDS,
Great Canadian Oil Sands Limited, Toronto (Ontario). (Assignee).
For primary bibliographic entry see Field 5D.
W76-10474

5F. Water Treatment and Quality Alteration

THE ROLE OF HYDROXYL RADICAL REACTIONS IN OZONATION PROCESSES IN AQUEOUS SOLUTIONS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 5D.
W76-10036

WATER, ITS EFFECTS ON LIFE QUALITY.
Water Quality Research Council, Lombard, Ill.
Proceedings, Seventh International Water Quality Symposium, April 23-24, 1974, Washington, D. C., 192 p, Edited by D. X. Manners.

Descriptors: *Water quality, Public health, Water purification, Potable water, Water resources, Water resources development, Planning, Water supply, Domestic water, Industrial water, Environmental engineering, Pesticide toxicity, Energy budget, Water softening.
Identifiers: Potable water standards, Chemical-disease relationships, Backward utilities, Foreign views on water quality, Industrial recycled water, Energy crisis.

The International Water Quality Symposium is an educational forum, held on alternate years, which brings together the world's foremost scientists, researches, conservationists, industrialists, government leaders, and others concerned with water quality. The Symposium is designed to translate the technical language of experts into layman's terms and bring to the public the lastest findings on the importance of water quality in such areas as health, environmental protection, sanitation, food processing, as well as various commercial and industrial applications. (Heiss-NWWA)
W76-10087

ANALYZING FOR ASBESTOS IN DRINKING WATER,
Municipal Environmental Research Lab., Cincinnati, Ohio.
For primary bibliographic entry see Field 5A.
W76-10240

SOFTENING AND COAGULATION SLUDGE-DISPOSAL FOR A SURFACE WATER SUPPLY,
Stilson (Alden E.) and Associates, Columbus, Ohio.
M. A. Burris, K. W. Cosens, and D. M. Mair.
American Water Works Association Journal, Vol. 68, No. 5, p 247-257, May 1976. 13 fig, 8 tab.

Descriptors: *Water quality control, *Sludge treatment, *Water softening, Surface waters, *Sludge disposal, *Byproducts, Treatment facilities, Calcium carbonate, Lagoons, Magnesium, Recycling, *Water supply, *Water treatment.

Results from pilot plant studies at two surface water treatment plants in Columbus, Ohio, dealing with the feasibility of recovering quicklime from the calcium carbonate in softening sludge as well as methods of sludge disposal are presented. The studies indicate that quicklime which is suitable for reuse can be recovered with an 86% calcium oxide content. Waste streams from centrifugation and sludge concentration processes which contain large quantities of dissolved magnesium require stabilization in lagoons, with the supernatant being returned to the surface stream below the intake dam. Recarbonation, concentration, and centrifuging of softening sludge are required to reduce impurities in the product quicklime in order to ensure continuous high quality for recycling. These steps, together with an efficient first stage clarification process, are essential when a turbid surface water supply is the source. Coagulation sludges must be removed ahead of the softening operation and kept separate. Alum sludges can be concentrated and dewatered by centrifuges or filter presses; the latter produce a more satisfactory cake and a better filtrate for return to the process. (Kreager-FIRL)
W76-10252

METHOD FOR TREATING FOULED WATER,
Mitsubishi Gas Chemical Co., Ltd., Tokyo (Japan). (Assignee).
For primary bibliographic entry see Field 5D.
W76-10467

METHOD FOR CONTROLLING SCALE,
Texaco Inc., New York. (Assignee).
For primary bibliographic entry see Field 5G.
W76-10469

WATER SOFTENER,
R. Derouineau.
U.S. Patent No. 3,951,802, 4 p, 3 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1346, April 20, 1976.

Descriptors: *Patents, *Water treatment, *Water softening, *Demineralization, *Hardness(Water), Ion exchange, Water purification, Water quality, Water quality control, Resins.

A water softener comprises at least two containers each one of which has an ion-exchange resin element as well as an inlet duct and an outlet duct, a supply duct connected to a source of water to be softened, a discharge duct for the softened water, a control valve for alternately connecting the containers to the supply duct and the discharge duct, a salt container, and a valve unit for passing a water stream through the salt container and alternately through that container which is not connected to the supply duct and the discharge duct. (Sinha-OEIS)
W76-10475

CLARIFIER APPARATUS,
Ecodyne Corp., Lincolnshire, Ill. (Assignee).
D. A. Young.
U.S. Patent No. 3,951,806, 4 p, 2 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1347-1348, April 20, 1976.

Descriptors: *Patents, Effluents, *Water purification, *Water treatment, *Water pollution treatment, Water pollution control, Water quality control, Sludge, Coagulation, Suspended solids, Chemicals, Equipment, Chemical precipitation.
Identifiers: Center post clarifier, Chemial treatment.

In water treating and clarification suspended solid particles act as 'seed' or nuclei to which newly formed precipitates adhere, creating a smaller number of larger, more dense and easily settled particles. Previously formed precipitates act as the 'seed' to speed the reactions between the incoming raw water and treatment chemicals. A primary object of the invention is to provide a center post clarifier which hydraulically recirculates solid precipitates or sludge upward into contact with the incoming raw water and added chemical agents. The clarifier has an uptake zone defined around the center support post forming an eductor tube having an upper and lower end which connect with an upper and lower portion of the mixing and recirculation chamber. A first set of openings is provided intermediate the center post for directing the flow of raw water upward into an intermediate portion of the uptake zone. A second set of openings positioned above the first set is provided for directing the remaining flow of raw water from the center post into the upper portion of the uptake zone. The relative flow rates of raw water causes sludge which has accumulated adjacent the lower end of the uptake zone to be lifted and recirculated with the raw water. (Sinh - OEIS)
W76-10479

WATER CONDITIONING APPARATUS,
C. H. Sanderson.
U.S. Patent No. 3,951,807, 5 p, 4 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1348, April 20, 1976.

Descriptors: *Patents, *Water treatment, *Water softening, *Demineralization, Scaling, Water quality, Water quality control, Magnetic studies, Equipment, Desalination.
Identifiers: Magnetic materials, Magnetic field.

An apparatus is described for treating water to reduce the buildup of scale in water systems. The device includes a cylindrical, multipoled magnetic core and an outer casing of magnetic material placed in radially spaced-apart relationship and includes ports for causing the water to pass through the magnetic field between the magnet and the magnetic casing. The passage of water through the apparatus causes materials that ordinarily form scale to form, instead, a loose slurry or mud-like substance which can be easily removed from the system by a simple blowdown or flushing. (Sinha - OEIS)
W76-10480

MODULAR CONTAINER,
Almag Pollution Control Corp., Baltimore, Md. (Assignee).
For primary bibliographic entry see Field 5D.
W76-10483

5G. Water Quality Control

COMPILATION AND ANALYSIS OF WATER QUALITY RIGHTS AND RESPONSIBILITIES IN HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
H. Yamauchi, and G. M. Hudes.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-254 835, $4.00 in paper copy, $2.25 in microfiche. Technical Memorandum No. 46, February 1976. 33 p., 298 ref. OWRT A-052-HI(1) 14-31-0001-5011.

Descriptors: *Water rights, *Water quality, *Regulation, *Institutions, *Hawaii, Legal aspects, Management, Administration, State jurisdiction, Evaluation, Bibliographies.
Identifiers: *Property rights, *Ahupua'a.

The ahupua'a of ancient Hawaii was a watershed-based institutional community. Water was of cardinal importance as a basis for, and object of the organization and administration of these largely self-sufficient communities. The concepts and doctrines of ahupua'a management, have recently been given reinvigorated legal standing by the 1973 Hanapepe decision of the Hawaii Supreme Court. This initial phase of the project consists of a general description of objectives and a bibliography compiled from library research in the concepts, rights, and responsibilities of the ahupua'a. The Hawaiian Collection of the University of Hawaii, the Bishop Museum, and the State Supreme Court libraries will provide the major information sources. Also maps and boundaries which may indicate additional geopolitical aspects of the ahupua'a will be reviewed.
W76-10001

OPERATION AND IMPACT OF NPDES IN REGION II, PART I,
Environmental Protection Agency, New York. Caribbean Construction Grants Branch.
W. J. Muszynski, and T. J. Olenik.
Water and Sewage Works, Vol. 123, No. 5, p 62-65, May, 1976. 2 tab, 7 ref.

Descriptors: *Waste water treatment, *Treatment facilities, *Permits, *Legislation, *Federal Water Pollution Control Act, Standards, Grants, Effluents, New Jersey, New York, Puerto Rico, Virgin Islands, *Water quality standards.
Identifiers: *National Pollutant Discharge Elimination System, Discharge permits.

The Federal Water Pollution Control Act Amendments provide Federal grants for construction of public waste water treatment works and establish interim effluent standards and the National Pollutant Discharge Elimination System (NPDES) permit program. Requirements are provided which systems must meet in order to receive permits. Region II includes Puerto Rico, the United States Virgin Islands, and the states of New York and New Jersey. The initial problems regarding permits for publicly owned discharges involved funding, pre-treatment of industrial wastes, combined flow, and the lack of discharge information. The last is the most serious problem, and it is complicated by the lack of understanding of the permit program by the municipalities. Several reviews of an application are necessary before a permit is issued. The steps in processing a permit include developing a preliminary draft of conditions for the treatment plant, certification by the state, public notice, and issuance of the permit. Attempts are made to verify the information provided on application forms. Where secondary treatment facilities do not currently exist, interim effluent requirements are aligned with the construction schedule for the secondary facilities. Secondary plants capable of achieving the required treatment level would be required to study what could be done to raise their treatment levels. In some instances existing secondary treatment plants would receive two compliance schedules, one related to the permit and the other related to construction grants for plant improvement. (Snyder-FIRL)
W76-10005

FLOATING STRUCTURAL PLASTIC TRUSS SYSTEM PROTECTS WASTE LAGOON LINING,
FMC Corp., San Jose, Calif.
R. K. Andrews.
Water and Sewage Works, Vol. 123, No. 1, p 55, January, 1976.

Descriptors: *Waste treatment, *Corrosion control, *Plastics, Construction Materials, Pipes, Joints(Connections), West Virginia.

A lagoon lining at a facility for waste treatment for a plant in Nitro, West Virginia, had to be designed to protect it from damage. The lagoon was planned to contain acidic wastes in variable depths. Supports and piping were to be designed for corrosion resistance and minimum outdoor maintenance. Structural plastic was designated for outlet and inlet piping supports for this reason. A pivoted truss system and floating platforms were designed and fabricated. A minimum lagoon water level prevents platform floats from resting on the lining. Fiberglass reinforced plastic piping having flexible joints at its truss pivot points was installed. The floating platform gave rise to some stability problems, but these have been corrected. The structural components have not noticeably deteriorated after approximately 2 years' operation. A long useful life is predicted for the system. (nyder-FIRL)
W76-10007

OPTIMAL ALLOCATION OF MEASUREMENT AND CONTROL RESOURCES WITH APPLICATION TO RIVER DEPOLLUTION,
Columbia Univ., New York. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 5A.
W76-10017

SHORT-TERM REGULATION OF BOD UPSETS IN AN ESTUARY,
Delaware Univ., Newark, Dept. of Chemical Engineering.
R. K. Jain, and M. M. Denn.
Transactions of the ASME: Journal of Dynamic Systems, Measurement, and Control, Vol. 98, No. 1, p 30-31, March, 1976. 1 fig, 5 ref.

Descriptors: *Water quality control, *Mathematical models, *Biochemical oxygen demand, Estuaries, Waste disposal, *Regulation, Water pollution control, Pollution abatement.

Local dynamic regulation at discharge points of effluent biochemical oxygen demand (BOD) upsets in an estuary was studied to determine its feasibility. The study was carried out with a mathematical model for an estuary of constant cross-sectional area, using parameters characteristic of the Delaware estuary. The solution requires the major response to be within the first tidal cycle, but it would be impossible for response to be so rapid in practice. Disturbances die out within approximately 3 days without controls, but averaging extends the period of disturbances to 6 days or more. Thus the spread of poor quality water is increased, although the peak disturbance is considerably reduced. This method of regulation does not appear to be a feasible means of maintaining water quality. (Snyder-FIRL)
W76-10020

COMPUTER-AIDED MODELLING OF STREAM PURIFICATION CAPACITY, PART I: NON-LINEAR DO MODEL,
Rensselaer Polytechnic Inst., Troy, N. Y.
For primary bibliographic entry see Field 5B.
W76-10024

COMPUTER-AIDED MODELLING OF STREAM PURIFICATION CAPACITY, PART II: MULTIPLE LINEAR CORRELATION METHOD,
Rensselaer Polytechnic Inst., Troy, N. Y.
For primary bibliographic entry see Field 5B.
W76-10025

INDUSTRIAL RESEARCH INSTITUTE STUDYING POLLUTION PROBLEMS OF SETO INLAND SEA,
Chugoku National Industrial Research Inst., Hiroshima (Japan).
For primary bibliographic entry see Field 5B.
W76-10031

ECOSYSTEMS ANALYSIS OF THE BIG CYPRESS SWAMP AND ESTUATIES,
Environmental Protection Agency, Athens, Ga. Surveillance and analysis Div.
For primary bibliographic entry see Field 6G.
W76-10046

CHEMICAL HAZARDS RESPONSE INFORMATION SYSTEM, A CONDENSED GUIDE TO CHEMICAL HAZARDS,
Coast Guard, Washington, D. C. Office of Marine Environment and Systems.
For primary bibliographic entry see Field 5A.
W76-10047

EVALUATION OF THE ARMY PESTICIDE MONITORING PROGRAM, EVALUATION OF DATA FROM ENVIRONMENTAL SAMPLES COLLECTED PRIOR TO 1 JANUARY 1974, PART I, SOIL, SEDIMENT, WATER,
Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
For primary bibliographic entry see Field 5A.
W76-10048

IRRADIANCE REDUCTION: EFFECTS ON STANDING CROPS OF THE EELGRASS, ZOSTERA MARINA IN A COASTAL LAGOON,
San Diego State Univ., Calif. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W76-10067

GROUND-WATER POLLUTION PROBLEMS IN THE NORTHWESTERN UNITED STATES,
Robert S. Kerr Environmental Research Lab., Ada, Okla.
For primary bibliographic entry see Field 5B.
W76-10083

PITLESS UNIT AND ADAPTER UPDATE.
For primary bibliographic entry see Field 8G.
W76-10092

ALFALFA SAFEGUARDS GROUND WATER.
Ground Water Age, Vol. 10, No. 9, p 31, May, 1976. 4 fig.

Descriptors: *Water pollution sources, *Nitrogen, *Nitrates, Groundwater, *Decomposing organic matter, *Alfalfa, Corn(Field), Feedlots.
Identifiers: *Abandoned feedlots.

Planting unused feedlots to alfalfa after abandonment will prevent nitrate pollution of ground water that otherwise might occur. It was found that corn is less efficient than alfalfa in removing accumulated nitrogen in the soil. Nitrogen normally builds

up in the top five to six feet of soil in a relatively immobile form. However, when feedlots are abandoned, organic nitrogen may be converted to nitrate which will infiltrate the soil with moisture once the impermeable surface seal breaks down. Planting of alfalfa will preclude free nitrogen conversion to nitrate by fixing the nitrogen in the root system in high concentration. (Heiss-NWWA)
W76-10093

GUARDIANS OF GROUND WATER QUALITY,
National Water Well Association, Worthington, Ohio.
T. E. Gass.
Water Well Journal, Vol. 30, No. 7, p 28-29, July, 1976.

Descriptors: *Water quality, *Water wells, *Groundwater, *Water pollution, Well regulations, Legislation.
Identifiers: *Water well construction, *Water well contractors, *Well completion techniques, Well construction guidelines.

The water well contractor plays an integral part in protecting the nations' ground water from contamination. Poorly constructed water wells represent ground-water quality's greatest hazard. Any well construction which provides a path for contaminants to enter a potable aquifer is a threat to public health as well as a detriment to the water well industry. State laws regulating the construction standards of water wells vary in effectiveness, and definitive language. Ultimately the contractor is responsible for the proper construction of water wells. In successfully completing this task the contractor not only preserves the nation's ground-water quality, but maintains the good reputation of the water well industry. (Heiss-NWWA)
W76-10096

SELECTING PACKER FLUIDS: HERE'S WHAT TO CONSIDER,
Delta Mud and Chemical Co., Houma, La.
For primary bibliographic entry see Field 8G.
W76-10099

PL92-500: MID-COURSE CORRECTION GRANTS OPTIONS; NEXT MOVE UP TO CONGRESS,
C. W. Heckroth.
Water and Wastes Engineering, Vol. 13, No. 5, p 28-32, May, 1976.

Descriptors: *Legislation, *Water pollution, *Water pollution treatment, *Water pollution control, Pollution abatement, Discharge(Water), *Water quality standards, Water treatment, Waste water treatment.
Identifiers: *Public Law 92-500, *National Commission on Water Quality, Interim legislation, Enforcement of standards, Water treatment funding.

Six essential and a number of secondary recommendations embody the text of Mid-course correction moves of the National Commission on Water Quality for Public Law 92-500. The six essential recommendations are: (1) Maintain the July, 1977 compliance date with uniform treatment requirements by both industry and publicly owned treatment works, but provide some flexibility to grant extensions and waivers, on a case-by-case basis, (2a) Maintain the 1983 interim goals, but postpone the 1983 requirements for application of uniform technologies five to ten years, (2b) Meet the 1983 interim water quality goal by application of the 1977 requirements to all discharges, (3) Decentralize regulatory and administrative functions of the national program by selective certification of states, (4) Stabilize the Federal construction grants program by assuring 75 percent federal financing for priority treatment needs, (5) Redefine the goal of elimination of discharge of pollutants as one stressing conservation and reuse of resources, (6) Authorize flexibility in control or treatment measures to irrigated agriculture and support salinity alleviation projects to reduce salt loads from sources other than man's activities. (Heiss-NWWA)
W76-10106

EFFECTS OF TREATED MUNICIPAL WASTEWATER ON OAT FORAGE AND GRAIN,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 5D.
W76-10119

AN ENVIRONMENTAL ASSESSMENT OF IMPACTS OF COAL DEVELOPMENT ON THE WATER SOURCES OF THE YAMPA RIVER BASIN, COLORADO AND WYOMING--PHASE-1 WORK PLAN,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 4C.
W76-10135

WATER QUALITY IMPLICATIONS OF CATTLE GRAZING ON A SEMIARID WATERSHED IN SOUTHEASTERN UTAH,
Oregon State Univ., Corvallis. Rangeland Resources Program.
J. C. Buckhouse, and G. F. Gifford.
Journal of Range Management, Vol. 29, No. 2, p 109-113, March, 1976. 1 fig, 1 tab, 28 ref.

Descriptors: *Public health, *Water quality, *Water pollution control, Watershed management, *Grazing, Coliforms, Cattle, *Range management, Rainfall-runoff relationships, Pine trees, Juniper trees, Land clearing, Human diseases, Recreation facilities, *Utah.
Identifiers: *Fecal pollution.

No adverse effects from fecal contamination were detected after cattle grazing was introduced in a semiarid watershed near Coyote Flat in Southeastern Utah. The area was seeded to crested wheatgrass in 1967 after pinyon-juniper chaining and windrowing of debris, and it was protected from grazing until 1974 when it was cattle stocked at 2 ha/AUM. There were no significant changes in fecal and total coliform production, indicating that potential health hazards from fecal pollution during such grazing are minimal. Most dry rangelands such as those covering the southwestern U.S. have few, if any, permanent streams. Cattle are maintained by hauling water to troughs or by creating water catchment ponds at local springs. Thus, there is little or no effective stream bank area from which bacteria can be flushed into a water course. On most chainings, especially those with debris in place, runoff water cannot flow any distance overland and very little rainfall runs off. (Jahns-Arizona)
W76-10171

NITROGEN REMOVAL DEPENDS ON FORM NUTRIENT TAKES,
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 5D.
W76-10174

AQUICULTURE - NEW BROOM CLEANS UP WASTEWATER,
Hazen and Sawyer, New York.
D. Walrath, and A. S. Natter.
Water and Wastes Engineering, p 38-41, February 1976.

Descriptors: *Aquiculture, *Waste water treatment, *Aquatic productivity, *Nutrient removal, Aquatic animals, Aquatic plants, Nitrogen, Phosphorus, Water quality control, Nutrients, Shellfish, Absorption.
Identifiers: Nutrient recovery.

Aquiculture is evaluated as a means of controlling nitrogen and phosphorus discharges in wastewater. Nutrient recovery provides potential food stuffs return as well as fuel sources and fertilizer compounds. Basic systems are described and current research outlined, especially with filter-feeding shellfish and macroscopic plant forms. Aquiculture system size depends on the area required for plant growth, which is determined by incident solar radiation, the plant species under culture and the efficiency of exposure to sunlight. In research on systems using unmixed basins, area requirements under favorable light conditions ranged from 6 to 60 acres/mgd (for summer operation in the northern U.S. and all year at subtropical latitudes). Area requirements under northern winter conditions may be over 10 times greater. Such requirements may be reduced by culturing a species with higher growth and uptake rates, culturing at higher concentrations, and mixing or other methods for increasing light exposure. The use of filter-feeding shellfish requires a heated system; waste heat from power plants is one viable source. Wastewater N:P ratios must be between 10:1 and 15:1 for a species which will uptake both nutrients effectively. (Jahns-Arizona)
W76-10180

LARGE-SCALE ESTUARINE WATER QUALITY MATRIX MODEL,
Texas Univ. at Austin. Dept. of Electrical Engineering.
For primary bibliographic entry see Field 5B.
W76-10191

A REVIEW ON DECISION MODELS IN ECONOMICS OF REGIONAL WATER QUALITY MANAGEMENT,
Technical Univ., of Denmark, Lyngby. Instituttet for Kemundustri.
M. Bundgaard-Nielsen, and C. L. Hwang.
Water Resources Bulletin, Vol. 12, No. 3, p 461-479, June 1976. 5 fig, 94 ref.

Descriptors: *Water quality control, *Management, Economics, *Optimization, *Mathematical models, *Reviews, River basins, Waste water treatment, Decision making, Systems analysis, Linear programming, *Bibliographies, *Regional analysis.
Identifiers: Taxation, Effluent charges, Multiobjective model, Nonlinear programming, Centralization models, Decentralization models, At-source treatment.

Literature specifically on decision models in economics of regional water quality management is reviewed critically and classified systematically. The concept of a basin-wide firm introduced by Kneese in 1964 is equivalent to the centralization system. Linear programming models for at-source treatment in water pollution control are presented in the earlier studies while nonlinear programming models are in recent ones. Since the economies of scale favor installation of a few large treatment plants, centralized waste treatment systems are studied by many using a number of programming techniques, including integer programming, dynamic programming, a nonconvex quadratic minimization algorithm, and an enumeration method. A general model for the basinwide firm may have the possibility of at-source treatment, centralized waste treatment plants, and by-pass piping to achieve regional water quality standards at a minimum cost. One of the major arguments in support of the taxation approaches is that they can achieve economic efficiency with minimum information requirements. Finally, it has been increasingly recognized that most decision problems involve multiple objectives. (Bell-Cornell)
W76-10195

GREAT LAKES POLLUTION CLEANUP STAGNATES AS PROBLEMS MOUNT,
Engineering News-Record, Vol. 196, No. 22, p 26-27, May 27, 1976. 1 tab.

Descriptors: *Sewage treatment, *Municipal wastes, *Industrial wastes, *Great Lakes, Great Lakes region, Lake Erie, Waste water treatment, Treatment facilities, Water quality, Water pollution effects, Legal aspects, Financing.

Municipal and industrial water pollution problems being experienced by cities on the shores of the Great Lakes are reviewed along with legal, financial, and bureaucratic difficulties impeding their solution. Lake Erie is generally considered to be the most severely polluted of the lakes, with water quality in Cleveland harbor being poor with respect to biochemical oxygen demand, phosphorus, nitrogen, total dissolved solids, and coliforms. A year-long holdup in the building of the city's 50 million gallon/day physical-chemical sewage treatment plant is the result of protests of potential contractors who were beaten out in the bidding. Other delays associated with environmental impact statements required by the Environmental Protection Agency are also a problem. Similar delays are being experienced by other cities on the Great Lakes in terms of deadlines set for both industry and the municipalities. In contrast to the Lake Erie situation, water quality for Lakes Michigan, Superior, and Huron is generally good. (Kreager-FIRL)
W76-10250

SYSTEMS MODELS FOR PHOSPHORUS MANAGEMENT IN FLORIDA,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5C.
W76-10277

THE SANTEE SWAMP AS A NUTRIENT SINK,
South Carolina Univ., Columbia. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W76-10288

PLANNING IMPLICATIONS OF DISSOLVED OXYGEN DEPLETION IN THE WILLAMETTE RIVER, OREGON,
Geological Survey, Portland, Oreg.
D. A. Rickert, W. G. Hines, and S. W. McKenzie.
In: Urbanization and Water Quality Control: American Water Resources Association Proceedings Series No 20, p 70-84, June 1975. 8 fig, 2 tab, 7 ref.

Descriptors: *Water quality control, *Low-flow augmentation, *Rivers, *Oregon, Water analysis, *Dissolved oxygen, Oxygen demand, Nitrification, Summer, Water temperature, Biochemical oxygen demand, Streamflow, Water management(Applied).
Identifiers: *Willamette River(Oreg), River-quality planning, Dissolved oxygen standards.

Basinwide secondary treatment of municipal and industrial wastewaters has resulted in a dramatic increase of summertime dissolved-oxygen (DO) concentrations in the Willamette River in Oregon. Rates of carbonaceous decay are very low (0.03 to 0.06/day), and point-source BOD loading now accounts for less than one-third of the satisfied oxygen demand. Nitrification is now the dominant DO sink. DO concentrations met the state standards in all reaches of the Willamette during the low-flow period of 1974. Mathematical modeling shows that low-flow augmentation from storage reservoirs was largely responsible for the standards being met. Future achievement of DO standards will require continued low-flow augmentation in addition to pollution control. Summertime flows above 6000 cfs will be needed even with increased treatment removals of oxygen-depleting materials. The greatest immediare incremental improvement in DO can be made through reduction in point-source ammonia loading. The pros and cons of upgrading treatment efficiencies for BOD removal would best be determined after ammonia loadings have been reduced to reasonable levels and the possibility of controlling a benthal-oxygen demand in Portland Harbor has been fully assessed. (Woodard-USGS)
W76-10332

SYSTEMATIC ANALYSIS OF FIELD SURVEY TECHNIQUES AND OPERATIONAL UTILITY OF ENVIRONMENTAL RESEARCH TO THE NAVY,
David W. Taylor Naval Ship Research and Development Center, Bethesda, Md.
S. C. Rainey.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California, on 13-15 November, 1973, December, 1974, p 31-38.

Descriptors: *Methodology, *Administration, *Planning, *Management, *Data collections, *Information retrieval, *Monitoring, On-site survey, Environmental research, Administration, Data storage and retrieval, Basic data collections, Environment.

The problems of the interaction between the Navy and the marine environment in any area are so involved that inventories are probably indicated. An adequate biological program is going to need some continuing integration and a highly responsive central information central storage location for information. (See also W76-10353) (Katz)
W76-10356

THE SYSTEMS CONCEPT AND POLLUTION CONTROL,
San Diego State Univ., Calif.
J. H. Mathewson.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California, on 13-15 November, 1973, December, 1974, p 39-44.

Descriptors: Ecosystems, *Monitoring, *Water quality control, *Systems analysis, Abatement, Water pollution, Forecasting, Dynamic programming, Hydrologic systems, Environment, Water pollution control, *Pollution abatement.

An aspect of pollution abatement that has not been adequately recognized is the integrated nature of the problems, the reactions of ecosystems to the problems; and the solutions required to solve the problems. Environments are dynamic systems consisting of complex interactions among many components, with a tendency to maintain themselves in response to outside perturbations. This self-regulating aspect requires the full natural complement of both living and non-living components -- water, light, minerals, plants, animals, microbes -- that interact to make up the whole system. Damage to a single component alters the integrity of the entire system because it reacts as a whole. (See also W76-10353) (Katz)
W76-10357

THE NEED FOR MORE INTERCOMPARABLE FIELD DATA AND WIDELY APPLICABLE SHORT-TERM SURVEY,
Naval Undersea Center, Kailua, Hawaii. Hawaii Lab.
E. C. Evans.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California, on 13-15 November, 1973, December, 1974, p 45-55.

Descriptors: *Bioassay, *Toxicity, *Methodology, Ecosystems, *Monitoring, *Data collection, *Bioindicators, *Water quality standards, Variability, Water pollution, Water quality, Marine animals, Surveys.

The range of biological responses of different marine organisms should be compared and integrated to encourage a practical degree of standardization among field biologists. The use of the Navy Environmental Protection Data Base (NEPBD) and the services of the Marine Environmental Management Office (MEMO) is advocated. (See also W76-10353) (Katz)
W76-10358

ANTIFOULING COATINGS AND THEIR INFLUENCE ON THE MARINE ENVIRONMENT,
Naval Postgraduate School, Monterey, Calif.
E. C. Haderlie.
In: Proceedings of the Conference on Marine Biology in Environmental Protection, held at San Clemente Island, California, on 13-15 November, 1973 December, 1974, p 139-145, 6 ref.

Descriptors: *Heavy metals, *Toxicity, *Periphyton, *Fouling, Ships, Aquatic algae, Nuisance algae, Ions, Crustaceans, Water pollution control.

Currently used antifouling coatings owe their effectiveness to the release of the ions of heavy metals into the sea water surrounding the surface protected by the coatings. These ions can contribute significantly to the concentration of heavy metals in the surrounding sea water and can pose a threat to the marine environment. New techniques that do not depend on toxic chemical formulations must be developed to prevent fouling on ships' hulls and other submerged structures. (See also W76-10353) (Katz)
W76-10365

CHANGES IN THE LEVELS OF ENVIRONMENTAL POLLUTANTS (HG, DDT, DIELDRIN, PCB) IN SOME SWEDISH FOODS,
National Swedish Food Administration, Stockholm. Food Lab.
For primary bibliographic entry see Field 5C.
W76-10368

PILOT PROJECT ON MARINE POLLUTION MONITORING UNDER THE FRAMEWORK OF IGOSS,
Intergovernmental Oceanographic Commission, Paris (France).
For primary bibliographic entry see Field 5B.
W76-10373

MARITIME CONSIDERATION OF OIL TRANSPORTATION,
Maritime Administration, Washington, D. C.
H. F. Casey.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum). Proceedings of a Symposium and Workshop, December 1974. p. 33-39.

Descriptors: *Transportation, *Ships, *Safety, *Accidents, *Hazards, *Oil industry, Mechanical equipment, Safety factors, Storage, Structural design, Structural engineering, International waters.
Identifiers: Tankers, Anti-Oil Spill Program.

Outlines are presented of the programs of the United States Government to insure safe and economic transportation of petroleum products with emphasis on oil tanker equipment and systems that will effectively protect the marine environment at a reasonable cost. (See also W76-10370) (Katz)
W76-10375

MARITIME CONSIDERATIONS,
Maritime Administration Washington, D.C.
J. J. Nachtscheim.
In: NBS Special Publication 409, Marine Pollution Monitoring (Petroleum). Proceedings of a Symposium and Workshop, December, 1974. p. 49-56.

Descriptors: *Administrative agencies, *Transportation, *Ships, Marine pollution, Oily

waters, Water pollution, Administrative decisions, Adoption of practices, Conferences, Safety, Accidents, Structural design, Oil industry, International waters.
Identifiers: *Tankers, *Ballast handling operations, *Oily water separators, *Segregated ballast, U.N. Conference on the Law of the Sea.

The U. S. Maritime Commission's role in pollution prevention is outlined. In regard to petroleum product transfer attention is paid to oil content metering, oily water separators and ballasts. Emphasis is placed on marine pollution abatement. (See also W76-10370) (Katz)
W76-10377

OIL SPILLAGE MONITORING, SAMPLING AND RECOVERY SYSTEMS,
Durham Associates, Inc., Milford, N. H.
For primary bibliographic entry see Field 5B.
W76-10382

POLLUTION-FREE WELL CUTTINGS DISPOSAL APPARATUS,
NL Industries, Inc., New York. (Assignee).
M. O. Stearns, and J. A. Gill.
U.S. Patent No. 3,901,254, 4 p, 4 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 937, No 4, p 1245, August 26, 1975.

Descriptors: *Patents, *Offshore platforms, *Oil industry, *Drilling, Exploration, Water pollution sources, Continental Shelf, Oil pollution, Water quality control, Environmental effects, Resources development.
Identifiers: *Outer Continental Shelf, Offshore technology, Oil slicks, Drilling cuttings.

This invention relates to the art of rotary well drilling in offshore locations using oily drilling fluids, and more particularly to an apparatus and process which permits the economical disposal of cuttings without polluting the body of water where the drilling takes place. A partially submerged down pipe extends both above the surface and below the surface of the water. A cuttings spraying device receives cuttings which have been separated from the drilling mud, sprays them with a cleaning liquid and discharges them into a flume which conveys them to the down pipe and discharges them interiorly of the down pipe and below the surface of the water. The wash or cleaning liquid is collected and pumped into a desilting means such as a cyclone and returned to the cuttings washer. A submersible pump within the down pipe at water level or adjacent the water level serves to pump oil released from the cuttings and which has risen to the level of the top of the liquid in the down pipe. An oil-water separator receives the mixture of oil and water pumped out of the down pipe. (Sinha - OEIS)
W76-10464

THIURAM POLYSULFIDE HEAVY METAL REMOVER,
Sagami Chemical Research Center, Tokyo (Japan). (Assignee).
For primary bibliographic entry see Field 5D.
W76-10466

METHOD FOR CONTROLLING SCALE,
Texaco Inc., New York. (Assignee).
J. F. Tate, and J. Maddox, Jr.
U.S. Patent No. 3,951,793, 4 p, 1 tab, 8 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1343, April 20, 1976.

Descriptors: *Patents, *Scaling, *Impaired water quality, *Water treatment, Calcium sulfate, Inhibitors, Chemical reactions.
Identifiers: Barium sulfate.

A method is described of controlling the build-up of scale deposits selected from the group consisting of calcium sulfate scale and barium sulfate scale in an aqueous system which comprises incorporating in the system a scale treating composition consisting essentially of about one part by weight of a sulfated-sulfonated polyethoxy alkyl phenol containing from about 8 to about 14 carbon atoms in the alkyl group and from about 4 to about 10 ethoxy groups, in admixture with from about 1 to 3 parts by weight of a C8-C14 alkyl benzene sulfonate for a time period of from about 5 to about 90 minutes at a temperature in the range of from about 50 deg. to about 60 deg C. (Sinha - OEIS)
W76-10469

GEOTHERMAL POWER METHOD,
For primary bibliographic entry see Field 3C.
W76-10470

FILTRATION PROCESS,
Commonwealth Scientific and Industrial Research Organization, Campbell (Australia); and Imperial Chemical Industries of Australia, Campbell; and New Zealand Ltd., Campbell (Australia). (Assignees).
For primary bibliographic entry see Field 5D.
W76-10473

WATER SOFTENER,
For primary bibliographic entry see Field 5F.
W76-10475

ALGAE HARVESTER,
J. C. Dodd.
U.S. Patent No. 3,951,805, 5 p, 4 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1347, April 20, 1976.

Descriptors: *Patents, *Algae, *Aquatic algae, Harvesting, Water harvesting, *Harvesting of algae, Water pollution, Water pollution sources, Water pollution control, Water pollution effects, Equipment.
Identifiers: Animal feed.

While the algae harvester can be used in a number of different ways, it has been successfully used in the way described. A main belt is provided of foraminous material preferably fine mesh for retaining or supporting a fibrous precoat but for permitting water or liquids to pass through. The main belt screen is trained over a number of rotary drums and guides. As the belt screen travels clockwise around the rotating forming drum and passes through the aqueous bath, fibrous material is deposited on the outer surface of the belt screen and forms in effect a precoat layer. The water discharges through an outlet line by siphon action or by connection to a low pressure source. Just as the belt screen leaves contact with the drum the belt screen passes over a suction tube within the drum. The precoat thus is subjected to a draining and compacting action through the belt screen and through the perforate drum wall by reason of the vacuum. A good deal of water is withdrawn from the deposited fibrous material which remains on the belt screen. From the idler drum the belt screen descends and advances clockwise in contact with the outer surface of a large filtering drum of foraminous nature and rotating within a tank. The tank is open at one end to a supply of water containing harvestable algae. There is a radially inward flow of water and contained algae, the latter depositing on and in the fiber layer. The separated water is removed from the interior of the drum. This water normally is discharged as treated effluent or filtrate. (Sinha - OEIS)
W76-10478

OIL SKIMMER MODULE WITH FREE FLOATING WEIR TROUGH,
A. J. Crisafulli.
U. S. Patent No. 3,951,810, 5 p, 7 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1349, April 20, 1976.

Descriptors: *Patents, *Oil spills, *Oil pollution, Water pollution treatment, *Water pollution control, Water quality control, *Skimming, Weirs, Flow, Equipment, *Separation techniques.
Identifiers: Gravity flow, Oil slicks, Skimmers.

A skimmer is provided by which floating pollutants such as oil along with a thin layer of water can be collected into a sump box or receptacle and then pumped to a storage tank or the like to enable separation of the pollutants and the water after which the water may be returned to the body of water. The sump box is provided with an opening below the water level to enable gravity flow of water and floating pollutants into the sump box. A weir placed in the opening in the sump box controls the quantity of water and pollutants discharged into the sump box. The weir is defined by an edge or edges of float supported members that can move in relation to the sump box to maintain a predetermined relationship to the surface of the body of water and includes flexible means between the sump box and weir to facilitate conveyance of the water and pollutants into the sump box. (Sinha - OEIS)
W76-10482

COALESCING UNIT FOR GRAVITY SEPARATOR,
Minnesota Mining and Mfg. Co., St. Paul. (Assignee).
D. L. Krueger.
U. S. Patent No. 3,951,814, 7 p, 7 fig, 1 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1350, April 30, 1976.

Descriptors: *Patents, *Oil spills, *Oil pollution, *Water pollution treatment, *Separation techniques, Water quality control, Water pollution control, Dispersion, Sorption, Coalescence.
Identifiers: Oil slicks, Dispersed liquid phase, Continuous liquid phase.

A separator removes a dispersed liquid phase from a continuous liquid phase. The separator is comprised of a housing having an inlet, an outlet, and a separation chamber between the inlet and outlet through which the liquid passes; and a separator element that tightly occupies the inside of the separation chamber. The separator element has discrete sections of two different kinds of media which are coalescing and sorbing media, interspersed in intimate contact with one another. The coalescing media has less resistance to liquid flow that the sorbing media, and extends through the separator element from the point at which the liquid enters to the point at which the liquid leaves the separator elements so as to establish substantially continuous, thin, minimal-pressure-drop channels through the element. The sorbing media is wetted by the dispersed liquid phase in preference to being wetted by the continuous liquid phase, so that the dispersed liquid phase is sorbed into the sorbing media. The most common liquid to be treated is oil-contaminated water, but coalescing and sorbing media are available for treating other liquids also. A separator element is typically used to treat a liquid containing small amounts of a dispersed liquid phase, but it may also be used to treat a more heavily contaminated liquid for a shorter period of time, as when bilge water is removed from a ship or when water carrying an oil slick is treated. (Sinha - OEIS)
W76-10484

HARVEST OF BIOLOGICAL PRODUCTION AS A MEANS OF IMPROVING EFFLUENTS FORM SEWAGE LAGOONS,
J. H. Neil.
Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report No. 38, Training and Technology Transfer Division (Water), Environmental Protection Service, Environment Canada, Ottawa, Canada, 1976, 35 p, 38 ref, 9 tab.

Descriptors: *Sewage lagoons, Harvesting, *Harvesting of algae, Effluents, Great Lakes, *Phosphorus, *Nitrogen, *Organic matter, Algae, Zooplankton, Midges, Ponds, Lagoons, *Waste water treatment, Water pollution control, Daphnia, Midges.
Identifiers: Duckweed, *Biological harvesting, Raw sewage.

The feasibility of removing phosphorus, nitrogen and organic matter through the harvesting of algae, duckweek (Lemna sp.), daphnia (Cladocera) or midge larvae (Tendipedidae) has been examined using analytical information from five Ontario sewage lagoons and information on production and chemical composition of the biota derived from the literature. Effluent analyses showed that an average of 1.7 ppm more total phosphorus must be removed to meet a 1 ppm total phosphorus standard for effluents. Harvesting part of the algae or duckweed crop could provide this reduction. Production figures from the literature indicate daphnia culture would provide the necessary removal from two to five lagoons. One instance where midge larvae production for an Ontario lagoon could be calculated indicated that a three-fold increase in standing crop would be required. Daphnia and midge larvae would provide immediately useful products for fish culture, the value of which could be used to offset part of harvesting and sewage treatment costs. Possible means of increasing production and harvesting methods are discussed. The culture and harvest of aquatic organisms provide additional benefits through the removal of nitrogen and other sewage constituents, and their culture is proposed as a possible alternative to the chemical precipitation practices currently in use. (Environment Canada)
W76-10500

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

AN LP-10 MODEL FOR COORDINATING MULTI-GROUP INPUTS IN RESOURCE PLANNING,
Hawaii Univ., Honolulu.
T. Liang.
Water Resources Bulletin, Vol. 12, No. 3, p 601-624, June 1976. 14 fig, 6 tab, 9 ref.

Descriptors: *Water resources development, *Comprehensive planning, *Linear programming, Natural resources, Optimization, Regional analysis, Resource allocation, Water quality, Economics, Water supply, Water demand, Social aspects, Constraints, Equations, Systems analysis, Mathematical models, Alternative planning.
Identifiers: *Multiple-input planning, Hydrographic areas, Kauai County(Hawaii).

The need for a model to quickly assess the impact of one or many proposals has never been greater, since the planning process has become open to almost everyone. The great magnitude of inputs to a planning process in terms of number and the degree of difference requires a model to resolve the difference, evaluate their overall impact, and finally coordinate the inputs into a meaningful as well as acceptable plan to all. Resources planning, perhaps exceeding any other planning process with respect to the great number of divergent opinions from a wide spectrum of specialist and citizen groups, probably needs such a model the most. This paper reports on the development of a linear programming model for guiding public as well as multi-discipline inputs in the planning and management of water and related natural resources. Optimal location of economic activities can be achieved by iterative use of the model. Kauai County, Hawaii is used in an example which illustrates the model use. (Bell-Cornell)
W76-10192

A REVIEW ON DECISION MODELS IN ECONOMICS OF REGIONAL WATER QUALITY MANAGEMENT,
Technical Univ., of Denmark, Lyngby. Instituttet for Kemundustri.
For primary bibliographic entry see Field 5G.
W76-10195

NETWORK MODELS AND THE IMPACT OF MODELING ASSUMPTIONS,
Alyeska Pipeline Service Co., Anchorage, Alaska.
For primary bibliographic entry see Field 4A.
W76-10196

6B. Evaluation Process

BASIN GOVERNANCE,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W76-10130

ARIZONA'S WATER SUPPLY-SOME REFLECTIONS,
Arizona Bureau of Mines, Tucson.
For primary bibliographic entry see Field 4A.
W76-10183

1975 ARIZONA AGRICULTURAL STATISTICS.
Agricultural Research Service, Tucson, Ariz. Statistical Reporting Service.
For primary bibliographic entry see Field 3F.
W76-10187

AN LP-10 MODEL FOR COORDINATING MULTI-GROUP INPUTS IN RESOURCE PLANNING,
Hawaii Univ., Honolulu.
For primary bibliographic entry see Field 6A.
W76-10192

A REVIEW ON DECISION MODELS IN ECONOMICS OF REGIONAL WATER QUALITY MANAGEMENT,
Technical Univ., of Denmark, Lyngby. Instituttet for Kemundustri.
For primary bibliographic entry see Field 5G.
W76-10195

STRENGTHENING LAKE-SHORELAND MANAGEMENT IN MASSACHUSETTS,
Massachusetts Univ., Amherst, Water Resources Research Center.
For primary bibliographic entry see Field 6E.
W76-10264

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COAL GASIFICATION IN SOUTHEASTERN OHIO: WATER SUPPLY AND DEMAND,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3E.
W76-10002

COST-EFFECTIVE GOAL,
For primary bibliographic entry see Field 5D.
W76-10032

1975 ARIZONA AGRICULTURAL STATISTICS.
Agricultural Research Service, Tucson, Ariz. Statistical Reporting Service.
For primary bibliographic entry see Field 3F.
W76-10187

URBAN SERVICE PRICING AND LAND USE: SOME PRELIMINARY RESULTS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
S. S. Skjei, and R. Freed.
Water Resources Bulletin, Vol. 12, No. 3, p 547-560, June 1976.

Descriptors: *Land use, *Pricing, Water resources, Control, Demand, Supply, Taxes, Economics, Regression analysis, Equations, Mathematical models, Urbanization, Cities, Municipal water.
Identifiers: *Economic analysis, Goods and services, *Public policy, Households, Utility function.

The use of public policy variables to control urban land use has been suggested or implied by a number of authors. This paper presents a conceptual foundation for doing so and the results of some empirical analyses based on this foundation. The conceptual analysis, based on a general equilibrium model of an urban economy, suggests functional forms which would appear to be of use and value in the developmental consequences brought about by changes in policy variables over which local units of government have control. Despite multicollinearity, regression analyses reveal that a statistically significant relationship does exist between characteristics of urban form and development and many local governmental policy variables. The method developed herein appears to constitute an alternative to more expensive approaches to the analysis of the relation between policy variables and land use. The empirical results tend to support earlier suggestions advanced by other researchers. (Bell-Cornell)
W76-10193

COST FUNCTIONS FOR ADDITIONAL GROUND WATER DEVELOPMENT,
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 4B.
W76-10194

IMPROVING THE FUEL VALUE OF SEWAGE SLUDGE,
Municipal Environmental Research Lab., Cincinnati, Ohio.
For primary bibliographic entry see Field 5E.
W76-10234

EVALUATION OF THE CIRIA PROTOTYPE MODEL FOR THE DESIGN OF SEWAGE-TREATMENT WORKS,
For primary bibliographic entry see Field 5D.
W76-10245

A PRESENT VALUE-UNIT COST METHODOLOGY FOR EVALUATING WASTEWATER RECLAMATION AND DIRECT REUSE AT A MILITARY BASE OF OPERATIONS,
Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Sanitary Sciences Div.
For primary bibliographic entry see Field 5D.
W76-10255

POLLUTANT ANALYSIS COST SURVEY,
National Bureau of Standards, Washington, D. C.
For primary bibliographic entry see Field 5A.
W76-10259

6D. Water Demand

COAL GASIFICATION IN SOUTHEASTERN OHIO: WATER SUPPLY AND DEMAND,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3E.

W76-10002

TACOMA'S NORTH FORK WELLS.
For primary bibliographic entry see Field 4B.
W76-10089

AN ENVIRONMENTAL ASSESSMENT OF IMPACTS OF COAL DEVELOPMENT ON THE WATER SOURCES OF THE YAMPA RIVER BASIN, COLORADO AND WYOMING--PHASE-1 WORK PLAN,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 4C.
W76-10135

6E. Water Law and Institutions

COMPILATION AND ANALYSIS OF WATER QUALITY RIGHTS AND RESPONSIBILITIES IN HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 5G.
W76-10001

INTERNATIONAL SURVEY ON EXISTING WATER RECHARGE FACILITIES.
International Association of Scientific Hydrology, Gentbrugge (Belgium).
For primary bibliographic entry see Field 4B.
W76-10085

PL92-500: MID-COURSE CORRECTION GRANTS OPTIONS; NEXT MOVE UP TO CONGRESS,
For primary bibliographic entry see Field 5G.
W76-10106

BASIN GOVERNANCE,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Economics.
D. J. Allee, H. R. Capener, and W. H. Andrews.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-255 099, $4.00 in paper copy, $2.25 in microfiche. Cornell Agricultural Economics Staff Paper, No. 75-25, December 1975. 22 p, 52 ref. OWRT B-136-UTAH(1) 14-31-0001-5141

Descriptors: *River basins, Regions, *Management, *Planning, Organizations, Political aspects, Economics, Social aspects, *Regional analysis.
Identifiers: *Governance.

This report is the result of three workshop sessions and communications inbetween. Social scientists need this kind of interaction, perhaps more than the natural and physical scientists who enjoy a longer history of dealing with natural resource problems. The complex organizational problems of regional and river basin management call for a major integrated effort of several social science disciplines. Some of these problems include analysis and possible restructuring of horizontal and vertical organizational systems of management and planning, budgeting at the regional level, cost sharing at the regional level, international boarder problems, integration of quantity and quality planning, research and planning and others. An approach to this research is recommended. Requirements of social science research on this problem are: first, support of an interdisciplinary social science research team through the necessary phases of the broad problem. The mapping and inventorying of river basin management and organization is the first stage of this work. A second requirement is to support the work through an adequate period of time to complete the stages necessary.
W76-10130

COST FUNCTIONS FOR ADDITIONAL GROUND WATER DEVELOPMENT,
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 4B.
W76-10194

STRENGTHENING LAKE-SHORELAND MANAGEMENT IN MASSACHUSETTS,
Massachusetts Univ., Amherst, Water Resources Research Center.
B. B. Berger, J. A. Kusler, and S. G. Klinginer.
Available from the National Technical Information Service, Springfield, Va., 22161, as PB-255 183, $4.00 in paper copy, $2.25 in microfiche. Publication No. 68, Completion Report FY-76-14, February 1976, 21 p. OWRT A-075-MASS(1)

Descriptors: *Management, Lakes, *Lake shores, *Information exchange, *Massachusetts, *Research priorities, Legislation.
Identifiers: *Lake rehabilitation.

A seminar was conducted in a series of eight sessions during the spring of 1975. Its major objectives were the following: (1) Identify lake problems and possible components of a conjunctive university, state, regional and local program to prevent problems or provide timely control of problems. Such a program might include requirements for data systems, predictive modelling, governance mechanisms, and lake rehabilitation. (2) Provide a basis for effective, continuing exchange of information between university group and public agencies on lake-related problems and research programs. (3) Help formulate research priorities and mechanisms for joint university-public agency research undertakings. (4) Provide a proposal for legislation or other public action designated to protect Massachusetts lakes. The report provides a set of general as well as specific recommendations for strengthening lake-shoreland management in Mass.; also included is a Draft Lake-Shoreland Regulation Bill.
W76-10264

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION: CUMBERLAND RIVER, BURKESVILLE, KENTUCKY.
Army Engineer District, Nashville, Tenn.
For primary bibliographic entry see Field 4A.
W76-10151

FLOOD PLAIN INFORMATION: EAST ARM LITTLE CALUMET RIVER, SALT CREEK-COFFEE CREEK, PORTER COUNTY, INDIANA.
Army Engineer District, Chicago, Ill.
For primary bibliographic entry see Field 4A.
W76-10152

FLOOD PLAIN INFORMATION: LITTLE EAGLE CREEK AND TRIBUTARIES, MARION COUNTY, INDIANA.
Army Engineer District, Louisville, Ky.
For primary bibliographic entry see Field 4A.
W76-10153

FLOOD PLAIN INFORMATION: CROOKED CREEK AND WILLIAMS CREEK, MARION COUNTY, INDIANA.
Army Engineer District, Louisville, Ky.
For primary bibliographic entry see Field 4A.
W76-10154

FLOOD PLAIN INFORMATION: TURKEY AND JOPLIN CREEKS, JOPLIN, MISSOURI.
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W76-10155

FLOOD PLAIN INFORMATION: PORTAGE OPEN BAY AND MAIN DITCH, VICINITY OF PORTAGEVILLE, MISSOURI.
Army Engineer District, Memphis, Tenn.
For primary bibliographic entry see Field 4A.
W76-10156

FLOOD PLAIN INFORMATION: SOQUEL CREEK, SANTA CRUZ COUNTY, CALIFORNIA.
Army Engineer District, San Francisco, Calif.
For primary bibliographic entry see Field 4A.
W76-10157

FLOOD PLAIN INFORMATION: SOUTH FORK SALT RIVER AND DAVIS CREEK, MEXICO, MISSOURI.
Army Engineer District, St. Louis, Mo.
For primary bibliographic entry see Field 4A.
W76-10158

FLOOD PLAIN INFORMATION: BIG SANDY RIVER, LAWRENCE COUNTY, KENTUCKY.
Army Engineer District, Huntington, W. Va.
For primary bibliographic entry see Field 4A.
W76-10159

SPECIAL FLOOD HAZARD INFORMATION: ARKANSAS RIVER, ARKANSAS CITY, KANSAS.
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W76-10160

SPECIAL FLOOD HAZARD INFORMATION: LABETTE AND LITTLE LABETTE CREEKS, PARSONS, KANSAS.
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W76-10161

SPECIAL FLOOD HAZARD INFORMATION: WHISKEY AND ROCK CREEKS, INDEPENDENCE, KANSAS.
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W76-10162

FLOOD PLAIN INFORMATION: LYNN CAMP AND EAST FORK LYNN CAMP CREEKS, CORBIN, KENTUCKY.
Army Engineer District, Nashville, Tenn.
For primary bibliographic entry see Field 4A.
W76-10163

FLOOD PLAIN INFORMATION: CLEAR CREEK-MULBERRY CREEK, VICINITY OF SHELBYVILLE, KENTUCKY.
Army Engineer District, Louisville, Ky.
For primary bibliographic entry see Field 4A.
W76-10164

FLOOD PLAIN INFORMATION: PIKE CREEK, NEW CASTLE COUNTY, DELAWARE.
Army Engineer District, Philadelphia, Pa.
For primary bibliographic entry see Field 4A.
W76-10165

FLOOD PLAIN INFORMATION: NORTH FORK KENTUCKY RIVER AND TRACE FORK, VICINITY OF HAZARD, KENTUCKY.
Army Engineer District, Louisville, Ky.
For primary bibliographic entry see Field 4A.
W76-10166

FLOOD PLAIN INFORMATION: DRY TURKEY AND BULL CREEKS, MCPHERSON, KANSAS.
Army Engineer District, Tulsa, Okla.

For primary bibliographic entry see Field 4A.
W76-10167

6G. Ecologic Impact Of Water Development

HIGHWAY-WILDLIFE RELATIONSHIPS VOLUME 1. A STATE-OF-THE-ART REPORT,
Urban Wildlife Research Center, Inc., Ellicott City, Md.
For primary bibliographic entry see Field 4C.
W76-10003

HIGHWAY-WILDLIFE RELATIONSHIPS VOLUME 2. AN ANNOTATED BIBLIOGRAPHY,
Urban Wildlife Research Center, Inc., Ellicott City, Md.
For primary bibliographic entry see Field 4C.
W76-10004

ECOSYSTEMS ANALYSIS OF THE BIG CYPRESS SWAMP AND ESTUATIES,
Environmental Protection Agency, Athens, Ga. Surveillance and analysis Div.
H. R. Carter, L. A. Burns, T. R. Cavinder, R. R. Dugger, and P. L. Fore.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-233 070, $10.75 in paper copy, $2.25 in microfiche. South Florida Environmental Project: Ecological Report No. DI-SFEP-74-51, June 1973, 375 p, 40 tab, 75 fig, 95 ref.

Descriptors: *Primary productivity, Hydrology, *Ecology, Biological communities, Dominant organism, *Vegetation establishment, *Florida, *Biota, Habitat, Canals, Ditches, *Estuaries, Benthic communities, Benthic plants, Fresh water fish, Wildlife, Fish, *Ecosystems, Nutrients, Sediments, Estuarine fish, Climatology, Macrobenthos, *Swamps, *Wetlands.
Identifiers: Ecosystem analysis, South Florida ecosystem, Snook, Ten Thousand Islands, Fahkahatchee Strand, *Big Cypress Swamp(Fla).

A two year study was conducted to obtain biological and hydrological information on south Florida's land, water, wildlife and fisheries resources. Field investigations during 1971-72 intensively examined the details of biotic community interactions with hydrologic conditions of disturbed and relatively unaffected regions of the Big Cypress Swamp and contiguous tidal wetlands and estuaries. Study results demonstrate the total dependence of the South Florida ecosystem on the hydroperiod. Canal drainage of upland wetlands which include cypress swamps and wet-prairies effected a 10 fold decrease in primary productivity. Drainage also effected a thinning of the forest canopy and induced a reduction in the rate of forest litter decomposition resulting in a buildup of litter as increased fuel for destructive wildfires. (Katz)
W76-10046

WATER, ITS EFFECTS ON LIFE QUALITY.
Water Quality Research Council, Lombard, Ill.
For primary bibliographic entry see Field 5F.
W76-10087

MODELS FOR EVALUATION OF HAZARDOUS WASTES,
Municipal Environmental Research Lab., Cincinnati, Ohio.
For primary bibliographic entry see Field 5B.
W76-10190

MINERAL CYCLING IN SOUTHEASTERN ECOSYSTEMS.
Savannah River Ecology Lab., Aiken, S.C.
For primary bibliographic entry see Field 5C.
W76-10266

NUTRIENT RECYCLING AND THE STABILITY OF ECOSYSTEMS,
Georgia Univ., Athens. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W76-10267

A THEORETICAL BASIS FOR ECOSYSTEM ANALYSIS WITH PARTICULAR REFERENCE TO ELEMENT CYCLING,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W76-10268

7. RESOURCES DATA

7A. Network Design

EVALUATION AND ADAPTATION OF SELECTED COMPUTER PROGRAMS TO WATER RESOURCE PROBLEMS IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 7C.
W76-10129

DESIGN A RIVER BASIN SAMPLING SYSTEM,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W76-10131

NETWORK MODELS AND THE IMPACT OF MODELING ASSUMPTIONS,
Alyeska Pipeline Service Co., Anchorage, Alaska.
For primary bibliographic entry see Field 4A.
W76-10196

7B. Data Acquisition

ELECTRICAL WATER PROSPECTING.
For primary bibliographic entry see Field 4B.
W76-10090

RECORDING EQUIPMENT BOOSTER.
For primary bibliographic entry see Field 8G.
W76-10091

WATER WELLS AS POSSIBLE INDICATORS OF TECTONIC STRAIN,
Tokyo Univ. (Japan).
For primary bibliographic entry see Field 8G.
W76-10105

THE MEASUREMENT OF ADENOSINE TRIPHOSPHATE IN PURE ALGAL CULTURES AND NATURAL AQUATIC SAMPLES,
Geological Survey, Doraville, Ga.
For primary bibliographic entry see Field 5A.
W76-10133

PRINCIPLES AND MEASURING TECHNIQUES OF TURBULENCE CHARACTERISTICS IN OPEN-CHANNEL FLOWS,
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 8B.
W76-10134

RESULTS OF INFILTRATION TESTS NEAR SCOTT CITY, WESTERN KANSAS,
Geological Survey, Lawrence, Kans.
For primary bibliographic entry see Field 2G.
W76-10136

TECHNIQUES FOR POWER MEASUREMENT FOR SURFACE AERATOR,
National Environmental Engineering Research Inst., Nagpur (India).
For primary bibliographic entry see Field 5D.
W76-10251

EVALUATION OF THIN FILM OIL SAMPLERS,
Coast Guard, Washington, D.C.
For primary bibliographic entry see Field 5A.
W76-10381

APPLICABILITY OF THE TECHNICON AUTOANALYZER I AND II SYSTEMS FOR SHIPBOARD ANALYSIS OF GREAT LAKES WATER SAMPLES,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W76-10497

APPROACH TO GLACIER MASS-BALANCE ANALYSIS UTILIZING TERRAIN CHARACTERIZATION,
Department of the Environment, Ottawa (Canada). Inland Waters Directorate.
For primary bibliographic entry see Field 2C.
W76-10499

7C. Evaluation, Processing and Publication

COMPUTER BASED CONTROL FOR WASTEWATER SYSTEMS,
Greeley and Hansen, Chicago, Ill.
For primary bibliographic entry see Field 5D.
W76-10019

COMPUTER-AIDED ANALYSIS OF ENVIRONMENTAL DATA, PART I: LINEAR REGRESSION, PRECISION AND ACCURACY,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 5A.
W76-10022

COMPUTER-AIDED ANALYSIS OF ENVIRONMENTAL DATA, PART II: BIOCHEMICAL OXYGEN DEMAND MODEL,
Rensselaer Polytechnic Inst., Troy, N. Y.
For primary bibliographic entry see Field 5A.
W76-10023

INTERPRETATION OF INTERNAL TRACER EXPERIMENTS AND LOCAL SOJOURN TIME DISTRIBUTIONS,
City Coll., New York. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W76-10039

EVALUATION AND ADAPTATION OF SELECTED COMPUTER PROGRAMS TO WATER RESOURCE PROBLEMS IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
L. A. Leland, and G. R. Higgins.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-255 108, $4.50 in paper copy, $2.25 in microfiche. Publication No. 67, Completion Report FY-76-13, June 1975. 68 p, 5 fig, append. OWRT A-070-MASS(1), 14-31-0001-4021.

Descriptors: *Computer programs, Open Channels, Hydraulics, Sampling, Frequency analysis, Evaluation, *Massachusetts, Hydrograph analy-

sis, Precipitation(Atmospheric), *Data processing, Adaptation, Forecasting.
Identifiers: *HYDRO programming system.

The HYDRO programming system consists of a library of computer sub-programs which have been assembled and modified to process hydraulic and hydrologic data under a common format. A total of twenty-five sub-programs are presently included in the system, each of which falls under one of the following categories: precipitation analyses, frequency analyses, hydrograph analyses, or open channel hydraulics. The twenty-five sub-programs selected provide a broad look at many of the more common problems encountered in the field today. They are intended to introduce the basic system to the engineer, satisfy many of his present needs, and be flexible enough to enable the timely inclusion of future programs.
W76-10129

SELECTED STREAMFLOW EXPERIENCE GRAPHS FOR SOUTHWESTERN PENNSYLVANIA,
Geological Survey, Harrisburg, Pa.
R. M. Beall.
Open-file report, April 1976. 40 p, 37 fig, 1 tab, 5 ref.

Descriptors: *Streamflow forecasting, *Flow characteristics, *Flow rates, *Statistical methods, *Pennsylvania, Systems analysis, Regression analysis, Data collections, Gaging stations, Hydrologic data, Hydrographs, Duration curves.
Identifiers: *Streamflow experience graphs(PA).

Standard streamflow characteristics commonly derived from data sequences include means and standard deviations of annual or monthly flows, low flows or flood volumes of given durations and return periods, and annual flood peaks of given return periods. This report describes and illustrates another analytical/statistical technique, the probability analysis of daily flows recorded during a long period of record, graphically presented in the form of a duration hydrograph. Such hydrographs are given for 34 streamflow records for gaging stations within the upper Ohio River basin principally in southwestern Pennsylvania. Because this method of analysis summarizes and classifies many years of discharge records on a day-to-day basis, its results can be viewed as an experience graph. Some operations and management applications are suggested. (Woodard-USGS)
W76-10132

RECONNAISSANCE DATA ON LAKES IN WASHINGTON--VOLUME 6. ADAMS, BENTON, DOUGLAS, FRANKLIN, GRANT, LINCOLN, WALLA WALLA, AND WHITMAN COUNTIES,
Geological Survey, Tacoma, Wash.
N. P. Dion, G. C. Bortleson, J. B. McConnell, and L. M. Nelson.
Washington Department of Ecology Olympia, Water-supply Bulletin 43, Vol 6, 1976. 407 p, 1 fig, 15 ref.

Descriptors: *Lakes, *Lake morphology, *Lake morphometry, *Water quality, *Washington, *Data collections, Bathymetry, Aerial photography, Lake shores, *Mapping, Water analysis, Physical properties, Chemical analysis.
Identifiers: Southeastern Washington lakes.

A total of 178 lakes in eight counties (Adams, Benton, Douglas, Franklin, Grant, Lincoln, Walla Walla, and Whitman) of southeastern Washington was sampled using helicopter or boat to obtain information on lake physical, cultural, and water-quality conditions. Physical parameters were determined from topographic and bathymetric (bottom-contour) maps of the lakes. If bathymetric maps were not available, the lakes were sounded and charted using a continuous-recording fathometer. By use of aerial photographs and lake depths, the bathymetric data were digitized and transferred to computer cards which served as input to a computerized program that calculated lake morphometric parameters (for example, lake volume, surface area, and length of shoreline). Vertical profiles of temperature and dissolved oxygen were measured in the deepest part of each lake. Secchi-disc visibility was determined also. Water samples were collected for color, nutrient, and specific-conductance analyses at depths 3.0 feet below the water surface and 3-5 feet above the lake bottom. Samples for fecal-coliform bacteria were collected at selected nearshore sites, approximately 100 feet offshore at a depth of 1 foot below the water surface. (Woodard-USGS)
W76-10138

RECONNAISSANCE DATA ON LAKES IN WASHINGTON--VOLUME 7. PEND OREILLE, SPOKANE, AND STEVENS COUNTIES,
Geological Survey, Tacoma, Wash.
N. P. Dion, G. C. Bortleson, J. B. McConnell, and L. M. Nelson.
Washington Department of Ecology Olympia, Water-Supply Bulletin 43, Vol 7, 1976. 267 p, 1 fig, 16 ref.

Descriptors: *Lakes, *Lake morphology, *Lake morphometry, *Water quality, *Washington, *Data collections, Bathymetry, Aerial photography, Lake shores, *Mapping, Water analysis, Physical properties, Chemical analysis.
Identifiers: Northeastern Washington lakes.

A total of 90 lakes in three counties (Pend Oreille, Spokane, and Stevens) of northeastern Washington was sampled using helicopter or boat to obtain information on lake physical, cultural, and water-quality conditions. Physical parameters were determined from topographic and bathymetric (bottom-contour) maps of the lakes. If bathymetric maps were not available, the lakes were sounded and charted using a continuous-recording fathometer. By use of aerial photographs and lake depths, the bathymetric data were digitized and transferred to computer cards which served as input to a computerized program that calculated lake morphometric parameters (for example, lake volume, surface area, and length of shoreline). Vertical profiles of temperature and dissolved oxygen were measured in the deepest part of each lake. Secchi-disc visibility was determined also. Water samples were collected for color, nutrient, and specific-conductance analyses at depths 3.0 feet below the water surface and 3-5 feet above the lake bottom. Samples for fecal-coliform bacteria were collected at selected nearshore sites, approximately 100 feet offshore at a depth of 1 foot below the water surface. (Woodard-USGS)
W76-10139

DIGITAL MODEL FOR SIMULATED EFFECTS OF GROUND-WATER PUMPING IN THE HUECO BOLSON, EL PASO AREA, TEXAS, NEW MEXICO, AND MEXICO,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 4B.
W76-10140

HYDROLOGIC DATA FOR URBAN STUDIES IN THE FORT WORTH, TEXAS METROPOLITAN AREA, 1974,
Geological Survey, Austin, Tex.
R. M. Slade Jr., and J. M. Taylor.
Open-file report, May 1976. 100 p, 3 fig, 5 tab.

Descriptors: *Hydrologic data, *Storms, *Rainfall-runoff relationships, *Small watersheds, *Urban runoff, *Texas, Streamflow, Basic data collections, Gaging stations, Rain gages, Peak discharge, Hydrographs, Mass curves.
Identifiers: *Fort Worth(Tex).

This report, which is the sixth in a series of reports published annually for the Fort Worth, Texas, area, presents basic hydrologic data collected in four study areas during the 1974 water year (October 1, 1973 to September 30, 1974). The four study areas within the metropolitan area are Sycamore Creek, Sycamore Creek tributary, Dry Branch, and Little Fossil Creek. Each year, storm events are selected for detailed rainfall-runoff analysis. The event during which the annual maximum discharge occurs is usually included in the selection. During the 1974 water year, storms selected for analysis occurred on October 11, October 12-13, 1973, and June 12, 1974 in the Sycamore Creek basin; October 11, 1973, June 7, and August 10, 1974 in the Sycamore Creek tributary basin; October 12-13, 1973, August 26-27, and September 20-21, 1974 in the Dry Branch basin; October 12-13, 1973, August 26, and September 20-21, 1974 in the Little Fossil Creek basin. Summaries of storm rainfall-runoff data for selected individual storms at streamflow stations and crest-stage partial-record stations are given. Detailed storm rainfall and runoff records, hydrographs, and mass curves for each station are shown. (Woodard-USGS)
W76-10141

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMEO, COLORADO TO CISCO, UTAH: PART 1. DATA SUMMARY,
Geological Survey, Denver, Colo.
R. Brennan, and R. U. Grozier.
Open-file report, 1976. 15 p, 3 fig, 6 tab.

Descriptors: *Salts, *Movement, *Water quality, *Colorado River, *Streamflow, Basic data collections, Discharge(Water), Chemical analysis, Correlation analysis, Gaging stations, Flow rates, Calcium, Magnesium, Harkness(Water), Sodium, Bicarbonates, Chloride, Dissolved solids, Specific conductivity.
Identifiers: *Salt-load computations.

Salt-load computations for inflow and outflow stations in the Grand Valley area of Colorado have been computed using five methods. The salt-load increase of the Colorado River from the Grand Valley has been computed for the Colorado-Utah State line station and the Colorado River near Cisco, Utah, station. Most of the salt loads give values about +30 percent of the average for all methods used, but differences of 70 percent do occur. Records presented in the basic-data report are regression curves of discharge versus specific conductance and of specific conductance versus calcium, magnesium, hardness, sodium, bicarbonate, chloride, dissolved solids, and sulfate; duration tables of daily discharge and of daily specific conductance for the period of record; and the daily specific-conductance data for the period of record for all stations in the study area. (See also W76-10143) (Woodard-USGS)
W76-10142

SALT-LOAD COMPUTATIONS--COLORADO RIVER; CAMEO, COLORADO, TO CISCO, UTAH: PART 2. BASIC DATA,
Geological Survey, Denver, Colo.
R. Brennan, and R. U. Grozier.
Open-file report, 1976. 222 p, 54 fig, 12 tab.

Descriptors: *Salts, Movement, *Water quality, *Colorado River, *Streamflow, Basic data collections, Discharge(Water), Chemical analysis, Correlation analysis, Gaging stations, Flow rates, Calcium, Magnesium, Hardness(Water), Sodium, Bicarbonates, Chloride, Dissolved solids, Specific conductivity, *Utah, *Colorado.
Identifiers: *Salt-load computations.

Basic data for the salt-load computations, Colorado River, Cameo, Colo., to Cisco, Utah, consists of regression curves of discharge versus specific conductance and specific conductance versus calcium, magnesium, hardness, sodium, bicarbonate, chloride, dissolved solids, and sulfate; duration tables of daily discharge and

daily specific conductance at six stream-gaging sites; and daily specific-conductance data for the period of record for all stations in the study area. Location of streamflow and water-quality stations are shown on a map. (See also W76-10142) (Woodard-USGS)
W76-10143

HYDROLOGIC DATA FOR LITTLE ELM CREEK, TRINITY RIVER BASIN, TEXAS, 1974,
Geological Survey, Austin, Tex.
R. M. Slade , Jr., and J. M. Taylor.
Open-file report, May 1976. 73 p, 2 fig, 3 tab.

Descriptors: *Hydrologic data, *Streamflow, *Flow rates, *Flood control, *Small watersheds, Texas, Basic data collections, Watershed management, Rainfall, Runoff, Storms, Gaging stations, Water storage, Flood protection.
Identifiers: *Elm Creek(Tex), *Trinity River basin(Tex).

This report, which is the fifteenth in a series of basic-data reports published annually for the Little Elm Creek study area, contains the rainfall, runoff, and storage data collected during the 1974 water year for the 75.5 sq mi area above the stream-gaging station Little Elm Creek near Aubrey, Texas. The locations of floodwater-retarding structures and hydrologic-instrument installations in the area are shown. The average rainfall above the stream-gaging station Little Elm Creek near Aubrey (study area) during the water year was 43.18 inches, or 115 percent of the 18-year (1957-74) average of 37.58 inches. Monthly rainfall totals ranged from 0.82 inch in March to 7.55 inches in June. The yearly mean discharge was 74.6 cfs. Three storm periods were selected for detailed computations. These computations include a time breakdown of rainfall and discharge with hydrographs and mass curves drawn for illustrations. (Woodard-USGS)
W76-10144

HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1974,
Geological Survey, Austin, Tex.
R. N. Mitchell.
Open-file report, May 1976. 60 p, 3 fig, 1 tab.

Descriptors: *Hydrologic data, *Storms, *Rainfall-runoff relationships, *Small watersheds, *Urban runoff, *Texas, Basic data collections, Gaging stations, Rain gages, Streamflow, Peak discharge, Hydrographs, Mass curves.
Identifiers: *Austin(Tex).

Rainfall and runoff data are presented for Waller Creek and Wilbarger Creek, Texas, for the 1974 water year (October 1, 1973 to September 30, 1974). The Waller Creek drainage area lies entirely within the city of Austin, with the headwaters originating in the northern part of the city. The creek flows south for 6.6 miles to the Colorado River. Storm sewers and street gutters divert runoff both into and out of the natural drainage area. The headwaters of Wilbarger Creek originate in Travis County near the Williamson County line. The creek flows southeasterly about 40 miles to the Colorado River. The Wilbarger Creek study area is about 15 miles north of the city of Austin. The weighted-mean rainfall in the Waller Creek area upstream from 23d Street was 38.40 in., or 18 percent above the mean annual rainfall for Austin of 32.49 in. Mean daily discharge was 4.12 cfs; annual runoff was 13.54 in., or 35 percent of rainfall. Four storm periods for the Waller Creek area, October 11, 1973; October 12-13, 1973; May 9, 1974; and August 28-29, 1974 were selected for analysis. Weighted-mean rainfall in the Wilbarger Creek area was 31.63 in., or 3 percent below the mean annual rainfall for Austin. Mean daily discharge was 1.72 cfs; annual runoff was 5.05 in., or 16 percent of rainfall. Two storm periods for the Wilbarger Creek area, October 11, 1973 and October 13, 1973 were selected for analysis. A summary of rainfall-runoff data for each storm is shown. Computations with hydrograph and mass curves for each storm are included. (Woodard-USGS)
W76-10145

HYDROLOGIC DATA FOR COW BAYOU, BRAZOS RIVER BASIN, TEXAS, 1974,
Geological Survey, Austin, Tex.
J. K. VanZandt.
Open-file report, May 1976. 63 p, 3 fig, 3 tab.

Descriptors: *Hydrologic data, *Streamflow, *Basic data collections, *Flood control, *Small watersheds, *Texas, Watershed management, Rainfall, Runoff, Gaging stations, Storms, Water storage, Flood protection.
Identifiers: *Cow Bayou watershed(Tex), Brazos River basin(Tex).

This report, which is the fourteenth in a series of basic-data reports published annually for the Cow Bayou study area, contains the rainfall, runoff, and storage data collected during the 1974 water year for the 85.0 sq mi area above the stream-gaging station Cow Bayou at Mooreville, Texas. The location of floodwater-retarding structures and hydrologic instruments in the area are shown. The weighted-mean rainfall over the study area during the water year was 31.61 inches, or 95 percent of the 16-year (1959-74) average of 33.13 inches. Monthly rainfall ranged from 0.58 inch in December to 7.93 inches in October. Yearly mean discharge at the stream-gaging station was 18.4 cfs, compared with the 16-year average of 35.0 cfs. Annual runoff at the stream-gaging station was 13,330 acre-ft. For the water year, one storm (Oct. 11, 1973) was selected for detailed computation. (Woodard-USGS)
W76-10146

HYDROLOGIC DATA FOR NORTH CREEK TRINITY RIVER BASIN, TEXAS, 1974,
Geological Survey, Austin, Tex.
C. C. Kidwell.
Open-file report, May 1976. 40 p, 2 fig, 3 tab.

Descriptors: *Hydrologic data, *Streamflow, *Flow rates, *Flood control, *Small watersheds, *Texas, Basic data collections, Watershed management, Storms, Rainfall, Runoff, Gaging stations, Water storage, Flood protection.
Identifiers: North Creek(Tex), *Trinity River basin(Tex).

This report contains the rainfall, runoff, and storage data collected during the 1974 water year for the 21.6 sq mi area above the stream-gaging station North Creek near Jacksboro, Texas. The locations of floodwater-retarding structures and hydrologic instrument installations in the area are shown. Five floodwater-retarding structures have a combined capacity of 4,425 acre-ft below flood-spillway crests and regulate streamflow from 16.3 sq mi, or 75 percent of the study area. The weighted-mean rainfall during the water year was 28.76 in., which is slightly less than the 17-year average of 29.69 in. for the period 1958-74. Monthly rainfall totals ranged from 0.00 in. in December to 7.07 in. in August. The yearly mean discharge at the stream-gaging station was 1.13 cfs, compared with the 14-year (1957-70) average of 5.75 cfs, prior to the notable effect caused by the floodwater-retarding structures. The annual runoff from the basin above the stream-gaging station was 821 acre-ft. Two storms were selected for detailed computations for the 1974 water year. The storms selected occurred on Oct. 12, 1973 and Aug. 29, 1974. Rainfall and discharge were computed on the basis of a refined time breakdown. Patterns of the storms are illustrated by hydrographs and mass curves. (Woodard-USGS)
W76-10147

NATIONAL WATER DATA STORAGE AND RETRIEVAL SYSTEM: INSTRUCTIONS FOR PREPARATION AND SUBMISSION OF GROUND-WATER DATA,
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 10D.
W76-10148

MAPS SHOWING GROUND-WATER CONDITIONS IN THE RANEGRAS PLAIN AND BUTLER VALLEY AREAS, YUMA COUNTY, ARIZONA--1975,
Geological Survey, Tucson, Ariz.
D. W. Wilkins, and W. C. Webb.
Water-Resources Investigations 76-34 (open-file report), April 1976. 3 sheets, 3 ref.

Descriptors: *Groundwater resources, *Water quality, *Water levels, *Irrigation, *Maps, *Arizona, Aquifers, Hydrogeology, Water wells, Pumping, Water yield, Hydrologic data, Water level fluctuations, Chemical analysis.
Identifiers: *Yuma County(Ariz).

This three-map report depicts ground-water level fluctuations (irrigation effects), hydrogeology, and water quality for the study area. The area in Ranegras Plain and Butler Valley in Yuma County, Ariz., where wells are most productive is underlain by sedimentary strata to depths of more than 1,000 ft. The strata consist of silt, sand, and some clay and gravel beds and include a few basaltic lava flows. Well yields are as much as a few thousand gallons per minute, but the specific yield generally is less than 25 gallons per minute per foot of drawdown. The less productive part of the area is mountainous, and the exposed rocks consist of volcanic flows, well-cemented sedimentary rocks, and some crystalline intrusive rocks; well yields generally are not more than 10 gallons per minute. In general water-level changes were minor in the Ranegras Plain and Butler Valley areas through 1975. For 1967-75, measured water-level changes in wells ranged from a rise of 2.2 ft to a decline of 10.8 ft. The water level declined nearly 26 ft in one well. The dissolved solids concentration in ground-water ranges from less than 300 to more than 2,000 mg/litre. (Woodard-USGS)
W76-10149

HYDROLOGIC UNIT MAP--1974, STATE OF WASHINGTON.
Geological Survey, Reston, Va.
For sale by USGS, Reston, Va 22092, price $1.25.
Hydrologic Unit Map, 1976. 1 sheet.

Descriptors: *Maps, *Hydrology, *Washington, Water resources, Data collections, Planning, Hydrologic systems, Regions, Land resources.
Identifiers: *Hydrologic unit maps(Wash), *Hydrologic boundaries, Subregions, Accounting units, Cataloging units.

This map and accompanying table show Hydrologic Units in the State of Washington that are basically hydrographic in nature. The Cataloging Units shown will supplant the Cataloging Units previously used by the U. S. Geological Survey in its Catalog of Information on Water Data (1966-72). The Regions, Subregions and Accounting Units are aggregates of the Cataloging Units. The Regions and Subregions are currently (1974) used by the U. S. Water Resources Council for comprehensive planning, including the National Assessment, and as a standard geographical framework for more detailed water and related land-resources planning. The Accounting Units are those currently (1974) in use by the U. S. Geological Survey for managing the National Water Data Network. (Woodard-USGS)
W76-10150

FLOOD PLAIN INFORMATION: CUMBERLAND RIVER, BURKESVILLE, KENTUCKY.
Army Engineer District, Nashville, Tenn.
For primary bibliographic entry see Field 4A.

W76-10151

FLOOD PLAIN INFORMATION: EAST ARM LITTLE CALUMET RIVER, SALT CREEK-COFFEE CREEK, PORTER COUNTY, INDIANA.
Army Engineer District, Chicago, Ill.
For primary bibliographic entry see Field 4A.
W76-10152

FLOOD PLAIN INFORMATION: LITTLE EAGLE CREEK AND TRIBUTARIES, MARION COUNTY, INDIANA.
Army Engineer District, Louisville, Ky.
For primary bibliographic entry see Field 4A.
W76-10153

FLOOD PLAIN INFORMATION: CROOKED CREEK AND WILLIAMS CREEK, MARION COUNTY, INDIANA.
Army Engineer District, Louisville, Ky.
For primary bibliographic entry see Field 4A.
W76-10154

FLOOD PLAIN INFORMATION: TURKEY AND JOPLIN CREEKS, JOPLIN, MISSOURI.
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W76-10155

FLOOD PLAIN INFORMATION: PORTAGE OPEN BAY AND MAIN DITCH, VICINITY OF PORTAGEVILLE, MISSOURI.
Army Engineer District, Memphis, Tenn.
For primary bibliographic entry see Field 4A.
W76-10156

FLOOD PLAIN INFORMATION: SOQUEL CREEK, SANTA CRUZ COUNTY, CALIFORNIA.
Army Engineer District, San Francisco, Calif.
For primary bibliographic entry see Field 4A.
W76-10157

FLOOD PLAIN INFORMATION: SOUTH FORK SALT RIVER AND DAVIS CREEK, MEXICO, MISSOURI.
Army Engineer District, St. Louis, Mo.
For primary bibliographic entry see Field 4A.
W76-10158

FLOOD PLAIN INFORMATION: BIG SANDY RIVER, LAWRENCE COUNTY, KENTUCKY.
Army Engineer District, Huntington, W. Va.
For primary bibliographic entry see Field 4A.
W76-10159

SPECIAL FLOOD HAZARD INFORMATION: ARKANSAS RIVER, ARKANSAS CITY, KANSAS.
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W76-10160

SPECIAL FLOOD HAZARD INFORMATION: LABETTE AND LITTLE LABETTE CREEKS, PARSONS, KANSAS.
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W76-10161

SPECIAL FLOOD HAZARD INFORMATION: WHISKEY AND ROCK CREEKS, INDEPENDENCE, KANSAS.
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W76-10162

FLOOD PLAIN INFORMATION: LYNN CAMP AND EAST FORK LYNN CAMP CREEKS, CORBIN, KENTUCKY.
Army Engineer District, Nashville, Tenn.
For primary bibliographic entry see Field 4A.
W76-10163

FLOOD PLAIN INFORMATION: CLEAR CREEK-MULBERRY CREEK, VICINITY OF SHELBYVILLE, KENTUCKY.
Army Engineer District, Louisville, Ky.
For primary bibliographic entry see Field 4A.
W76-10164

FLOOD PLAIN INFORMATION: PIKE CREEK, NEW CASTLE COUNTY, DELAWARE.
Army Engineer District, Philadelphia, Pa.
For primary bibliographic entry see Field 4A.
W76-10165

FLOOD PLAIN INFORMATION: NORTH FORK KENTUCKY RIVER AND TRACE FORK, VICINITY OF HAZARD, KENTUCKY.
Army Engineer District, Louisville, Ky.
For primary bibliographic entry see Field 4A.
W76-10166

FLOOD PLAIN INFORMATION: DRY TURKEY AND BULL CREEKS, MCPHERSON, KANSAS.
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W76-10167

MINIMIZATION OF CORE REQUIRED IN ROUTING THROUGH A CHANNEL NEWTWORK,
Hydrocomp International, Palo Alto, Calif.
For primary bibliographic entry see Field 2E.
W76-10243

THE SIMULATION OF SEDIMENT TRANSPORT,
Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 2J.
W76-10244

SYSTEMATIC ANALYSIS OF FIELD SURVEY TECHNIQUES AND OPERATIONAL UTILITY OF ENVIRONMENTAL RESEARCH TO THE NAVY,
David W. Taylor Naval Ship Research and Development Center, Bethesda, Md.
For primary bibliographic entry see Field 5G.
W76-10356

THE NEED FOR MORE INTERCOMPARABLE FIELD DATA AND WIDELY APPLICABLE SHORT-TERM SURVEY,
Naval Undersea Center, Kailua, Hawaii. Hawaii Lab.
For primary bibliographic entry see Field 5G.
W76-10358

UNITED NATIONS ENVIRONMENT PROGRAM EARTHWATCH AND MARINE POLLUTION,
National Oceanic and Atmospheric Administration, Rockville, Md.
For primary bibliographic entry see Field 5B.
W76-10371

SCIENTIFIC PROBLEMS OF THE SYSTEMS FOR GLOBAL MONITORING AND INVESTIGATION OF OIL POLLUTION IN THE WORLD OCEAN,
State Oceanographic Inst., Moscow (USSR).
For primary bibliographic entry see Field 5B.
W76-10372

MARINE POLLUTION DATA ARCHIVING AND EXCHANGE,
National Oceanic and Atmospheric Administration, Silver Spring, Md. Environmental Data Service.
For primary bibliographic entry see Field 5A.
W76-10376

CANADIAN PARTICIPATION IN THE INTERNATIONAL HYDROLOGICAL DECADE, FINAL REPORT, (VOLUME 2), RESEARCH REPORTS.
International Hydrological Decade, Ottawa (Ontario). Canadian National Committee.
For primary bibliographic entry see Field 2A.
W76-10489

PROGRAM ESOPH - EXTENDED SOPH, SIMULATION OF TIME-VARIANT PIEZOMETRIC SURFACE IN A CONFINED, LEAKY AQUIFER SUBJECTED TO PUMPING.
Department of the Environment, Ottawa (Canada). Inland Waters Directorate.
A. Vandenberg.
Water Resources Branch, 1976, 33 p. 3 fig., 3 ref. 1 tab.

Descriptors: *Pumping, *Computer programs, *Pumps, *Leakage, *Aquifers, Freshwater, Water quality, Water resources, Computers, Simulation(Analysis), Inland waterways, Efficiencies, Piezometry, Model studies.
Identifiers: Leaky aquifers.

Modifications to the mathematical development, to the computer program, and to the input requirements are described which extend program SOPH to program ESOPH for the simulation of leaky aquifers and for the use of variable dimensions of the elementary rectangle of the finite difference grid. This publication is not complete in itself; it should be read in conjunction with Vanden Berg (1974) on 'A Digital Simulation of Horizontal Salt Water Encroachment Induced by Fresh Water Pumping' (See W75-04875) and Vanden Berg (1974) on 'Program SOPH - Simulation of Time Variant Piezometric Surface in a Confined Aquifer Subjected to Pumping'. (See W75-06737) (Environment Canada)
W76-10498

APPROACH TO GLACIER MASS-BALANCE ANALYSIS UTILIZING TERRAIN CHARACTERIZATION,
Department of the Environment, Ottawa (Canada). Inland Waters Directorate.
For primary bibliographic entry see Field 2C.
W76-10499

8. ENGINEERING WORKS

8A. Structures

FLOATING STRUCTURE ARRANGEMENT,
D. E. Johnson, and R. M. Jones.
U.S. Patent No. 3,951,085, 8 p, 37 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 945, No 3, p 1115, April 20, 1976.

Descriptors: *Patents, *Engineering structures, *Concrete structures, *Resources development, Water resources development, Islands, Continental Shelf.
Identifiers: *Outer Continental Shelf, Floating structures, Floating islands, Artificial islands, Offshore technology, Modular construction.

The modular construction of floating reinforced concrete structures permits the assembly of manmade islands of almost any desired size. The basic unit in the structure may be provided by a triangular module consisting of three flat slabs of ferroce-

ment interconnected by rods. These units initially are planar, with the rods between the slabs subsequently being bent to provide a triangular configuration. These triangular modules are associated together to form a larger triangular assembly which is secured together by rods extending through the loops formed by the rods at the apexes of the triangular modules. By pointing all of the triangular modules in the same direction in forming the larger triangular structure, the resulting unit has more triangles within its perimeter than the total number of the modules present. The spaces at the apexes of the triangular modules are filled in with more ferrocement, and the larger triangular unit is provided with reinforced skins. Reinforcement comes from wire mesh together with rod units which extend from each apex to a point just beyond the opposite side, providing projecting loops along the sides and at the corners of the triangular unit. The unit is then placed in a mold having a thin layer of ferrocement on the bottom surface, which is vibrated to cause the ferrocement to penetrate the wire mesh. Both surfaces of the unit may be enclosed in this manner. Still larger assemblies are made from the bigger modules. The larger triangular units are provided with vertical walls to give them depth and with additional skin surfaces to define areas upon which subsequent construction may be made. (Sinha - OEIS)
W76-10465

8B. Hydraulics

DESIGN OF A STORMWATER SEWER BY NONLINEAR PROGRAMMING--1,
Sherbrooke Univ. (Quebec). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W76-10034

CHANGE IN DRAWDOWN CAUSED BY ENLARGING A WELL IN A DOLOMITE AQUIFER,
Geological Survey, Columbus, Ohio. Water Resources Div.
For primary bibliographic entry see Field 4B.
W76-10088

CORROSION,
Plummer and McDannald Co., Galena, Ohio.
For primary bibliographic entry see Field 8G.
W76-10095

PREDICTING PRODUCTIVE TRENDS RELATED TO WRENCH FAULTS,
Exxon Production Research Co., Houston, Tex.
For primary bibliographic entry see Field 8E.
W76-10100

TUBING-CASING RECLAMATION SAVED SHELL OVER $3 MILLION,
Shell Oil Co., New Orleans, La.
For primary bibliographic entry see Field 8G.
W76-10101

HEAVY COLLARS AID HOLE CONTROL,
Shell Development Co., Houston, Tex.
For primary bibliographic entry see Field 8G.
W76-10102

WELL FIELD MAINTENANCE AVOIDS CRISES,
Moody and Associates, Inc., Columbus, Ohio.
For primary bibliographic entry see Field 8G.
W76-10103

HOW TO DRILL TROUBLESOME SHALES,
Dresser Industries, Inc., Houston, Tex. Magcobar Div.
For primary bibliographic entry see Field 8G.
W76-10108

EVALUATION AND ADAPTATION OF SELECTED COMPUTER PROGRAMS TO WATER RESOURCE PROBLEMS IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 7C.
W76-10129

PRINCIPLES AND MEASURING TECHNIQUES OF TURBULENCE CHARACTERISTICS IN OPEN-CHANNEL FLOWS,
Geological Survey, Reston, Va.
R. S. McQuivey.
Available from Supt. of Documents, GPO, Wash., D.C. 20402, price $1.80. Professional Paper 802-A, 1973. 82 p, 32 fig, 1 tab, 19 ref, append.

Descriptors: *Open channel flow, *Turbulence, *Measurement, *Anemometers, *Methodology, Instrumentation, Equations, Energy, Movement, Heat transfer, Evaluation.
Identifiers: *Hot-film anemometry.

Recent improvement in measurements of turbulence in water is due to the development of hot-film anemometry, which has given the researcher a tool for studying the structure of turbulence in open-channel flows. The fine spatial resolution (due to the small size of the sensor) and the good frequency response of the hot-film anemometer system are unmatched by any other system now available. A detailed description of instrumentation, sensor selection, and theory of operation is presented along with a discussion of calibration characteristics, heat-transfer relations, hot-film and hot-wire measurements, and possible sources of errors in turbulence measurements. Explained in detail is a procedure to circumvent contamination problems so that measurements can be made in natural rivers and streams. Also presented is a mathematical and experimental justification for the procedure. Aspects of analog and digital data reduction are discussed along with some guidelines to insure meaningful measurement of turbulence characteristics. (Woodard-USGS)
W76-10134

SYMPOSIUM ON MODELING TECHNIQUES, VOLUME II.
American Society of Civil Engineers, New York.
Proceedings of the 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE, San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, 1975. 883 p. $30.00.

Descriptors: *Model studies, *Mathematical models, *Hydraulic models, Harbors, Resonance, Coasts, Beaches, Hydrodynamics, Water quality, Water pollution, Estuaries, Sedimentation, Finite element analysis, Storms, Storm surge, Waves(Water), Ocean waves, Hydraulics.

The objective of this symposium was to provide a forum in which the state-of-the-art of various types of models could be discussed and to provide a mechanism by which not only the relative merits of mathematical and physical models could be reviewed but also, and more fundamentally, the applicability of models to specific problems could be evaluated. The program focused on nearly all aspects of modeling as applied to rivers, harbors, oceans, and coastal areas. This volume contained the papers from sessions on harbor resonance, coastal movable-bed models, coastal hydrodynamic processes, water quality, estuaries, coastal sediment processes, finite elements, storm surges, and wave structure interaction. (See also W76-10416 thru W76-10463) (Sims-ISWS)
W76-10415

RESONANCES IN HARBORS WITH VARIABLE DEPTHS,
Florida Atlantic Univ., Boca Raton. Dept. of Ocean Engineering.
C-L. Su.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 803-815, 1975. 2 fig, 2 tab, 11 ref.

Descriptors: *Resonance, *Harbors, *Waves(Water), *Model studies, Mathematical models, Equations, Fluid mechanics, Hydraulics, Coasts, Engineering structures, Estuaries, Oceanography.
Identifiers: *Harbor resonances.

Asymptotic formulas were derived for both the free surface elevation and the velocity at the entrance of an arbitrary harbor along a straight coast. These algebraic formulas depended on the trapped modes and the continuum spectrum of the open ocean and also on the normal modes of the harbor basin. The maximums of the modulus of the averaged entrance velocity were all equal and the corresponding wave numbers were defined as the resonant wave numbers. Determination of the resonant wave numbers did not depend on the spectrums of the open coast, but depended critically on the two neighboring normal modes. In deriving the formulas it was assumed that the width of the harbor entrance is small compared to both the incident wave length and the harbor dimension, but in practice they can be relaxed. (See also W76-10415) (Sims-ISWS)
W76-10416

WAVE RESPONSE OF OFFSHORE BOTTOMLESS HARBORS,
Tehran Univ. (Iran).
H. Raissi.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 816-835, 1975. 22 fig, 1 tab, 20 ref.

Descriptors: *Harbors, *Waves(Water), *Model studies, Hydraulic models, Mathematical models, Laboratory tests, Resonance, Fluid mechanics, Hydraulics, Engineering structures, Oceanography.
Identifiers: *Offshore harbors, *Bottomless harbors, Wave oscillations.

Two and three dimensional bottomless harbors were investigated: a rectangular bottomless harbor and a circular bottomless harbor with no entrance, a 19 deg entrance and a 45 deg entrance. It was found: (1) the theoretically predicted resonant frequencies of a bottomless harbor agrees well with the experimental values, but the experimental amplification factors at resonance are generally somewhat smaller than the theoretical results; (2) the approximate theoretical solution of Evans and Morris agrees with a numerical solution and the bottomless harbor is effectively transparent to the incoming waves for certain frequencies, but the experimental data did not show any significant reduction in reflected waves; and (3) decreasing the depth of immersion of barriers caused a decrease in the amplification factor inside the harbor during oscillation, and narrowing the width of the harbor entrance caused an increase on amplification factor. (See also W76-10415) (Sims-ISWS)
W76-10417

NONLINEAR LATERAL OSCILLATION IN A HARBOUR MODEL,
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
S. Nakamura.

In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 836-853, 1975. 7 fig, 1 tab, 18 ref, 1 append.

Descriptors: *Harbors, *Waves(Water), *Model studies, Hydraulic models, Laboratory tests, Coasts, Shores, Fluid mechanics, Engineering structures, Estuaries, Hydraulics, Oceanography.
Identifiers: *Wave oscillations.

This paper described a part of the experimental results which have been carried out for control or suppression of water waves on coast and in harbor. Two cascaded pairs of breakwaters were considered in a harbor model. The period of the wave was in the range of 0.15 min to 1.5 min. The trend of the wave height ratio may be understood by linear theory of harbor oscillation or of edge wave. An experiment with a wave of 9 sec in period showed that the wave form is edge wave like and fairly stable in the lateral oscillation between the two pairs of the breakwaters. The result indicated an existence of a conoidal edge wave as a solution of two dimensional nonlinear equations for harbor oscillation. The nonlinear lateral oscillation can be easily regulated by a simple arrangement of the boundary condition in the harbor model, for example, by changing the width of the opening at the first pair of the breakwaters, by increasing the water depth in the harbor, by giving gentle slopes to both sides of the lateral wall in the harbor model, or by changing the area of the harbor model. (See also W76-10415) (Sims-ISWS)
W76-10418

NUMERICAL PREDICTION OF HARBOR RESPONSES,
Hawaii Univ., Honolulu. Dept. of Ocean Engineering.
T. T. Lee, and M. A. Sklarz.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 854-873, 1975. 11 fig, 1 tab, 4 ref.

Descriptors: *Harbors, *Waves(Water), *Model studies, *Hawaii, Mathematical models, Hydraulic models, Ocean waves, Beaches, Barriers, Engineering structures, Hydraulics, Fluid mechanics, Hydrodynamics.
Identifiers: *Small-boat harbors, *Honolulu(Hawaii), Harbor improvements.

This paper covered the use of a numerical simulation model to predict the harbor responses as excited by a periodic wave action. The method was applied to a small boat harbor improvement project located near Honolulu, Hawaii. The results obtained from the numerical model were compared with those measured from a hydraulic model. Despite the fact that the relationship of numerical prediction to measurement in the hydraulic model was uneven, the comparison seemed fair for berthing areas but poor in the vicinity of the entrance channel. It should be emphasized that at this stage of its development, the shallow water wave model cannot be expected to give an absolute quantitative picture of the harbor and environs. If the reflectance functions at beaches, barriers, harbor walls, and open boundaries can be improved, it is practicable that the numerical model could be fully developed as an effective tool in the determination of the best harbor improvement plan among a variety of alternatives. This paper described the basic theory, computational aspects, and considerations that went into adapting this general shallow water wave numerical model as written by H.G. Loomis. The model assumed that the fluid obeys the Navier-Stokes equations of momentum and continuity with the assumption that the velocities are uniform along a vertical line from the water surface to the sea floor and that the water-level change is small compared to the depth. Also, the non-linear advection and coriolis terms were neglected. (See also W76-10415) (Sims-ISWS)
W76-10419

FREE OSCILLATIONS IN BAYS AND HARBORS,
Department of the Environment, Ottawa (Ontario). Oceanography Branch.
T. S. Murty, and J. D. Taylor.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 874-887, 1975. 5 fig, 7 tab, 5 ref.

Descriptors: *Bays, *Harbors, *Waves(Water), *Model studies, Mathematical models, Computer models, Hydrodynamics, Hydraulics, Water level fluctuations, Water levels, Winds, Atmospheric pressure, Numerical analysis.
Identifiers: *Wave oscillations, Free oscillations, Oscillation spectra.

A method was described which has been used to calculate the frequencies of natural oscillations in bays and harbors. The method consisted of the generation of waves in a computer model of the bay in question and the use of spectranalysis to calculate the energy vs. frequency at selected points in the bay. The modeling program was a two-dimensional finite difference representation of the vertically integrated equations of hydrodynamics. The grid used was equally spaced in latitude and longitude. The model may be applied to any body of water by simply feeding in the depths at the grid points. When applied to oscillations in a bay, the water heights across the mouth of the bay were set to zero and any appropriate forcing function (wind or pressure) was applied. After running the model, the time series of water heights at any point of interest in the basin were saved and fed into a spectrum analysis program. Computer plots of the spectrum and of the spectrum vs. time may be obtained. Tests have been made showing the validity of the method and some of its limitations. Results were shown for some of the bays the method has been applied to. (See also W76-10415) (Sims-ISWS)
W76-10420

COMPUTATIONS OF HARBOR OSCILLATIONS BY RAY METHODS,
Technical Univ., of Denmark, Lyngby. Lab., of Applied Mathematical Physics.
J. Larsen, and P. L. Christiansen.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 888-906, 1975. 11 fig, 16 ref.

Descriptors: *Harbors, *Waves(Water), *Model studies, Mathematical models, Fluid mechanics, Hydraulics, Shores, Coasts, Refraction(Water waves), Reflectance, Shallow water, Oceanography.
Identifiers: *Denmark, *Wave oscillations.

A numerical investigation of oscillations in harbor basins based on ray methods was presented. A computer program has been developed for the tracing of all possible reflected and diffracted rays produced by an incident gravity wave in an arbitrary basin with straight walls and constant water depth. Attenuation mechanisms that limit the number of rays needed for the computation of the field at a given point with a certain accuracy were discussed. Amplitude diagrams for the harbor oscillations in actual harbors obtained by application of the programs were shown. (See also W76-10415) (Sims-ISWS)
W76-10421

TESTS ON THE EQUILIBRIUM PROBILES OF MODEL BEACHES AND THE EFFECTS OF GRAIN SHAPE AND SIZE DISTRIBUTION,
Tetra Tech, Inc., Pasadena, Calif.
For primary bibliographic entry see Field 2L.
W76-10422

PHYSICAL MODELING OF SCOUR INITIATION AND SEDIMENT TRANSPORT IN DISTORTED TIDAL MODELS,
Florida Univ., Gainesville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10423

TIME GROWTH OF TIDAL DUNES IN A PHYSICAL MODEL,
Queen's Univ., Kingston, Ontario. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10424

LABORATORY EFFECTS IN COASTAL MOVABLE-BED MODELS,
Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2L.
W76-10425

SIMULATION OF DELTA BUILDING PROCESS,
Central Water and Power Research Station, Poona (India).
For primary bibliographic entry see Field 2L.
W76-10426

MOVABLE-BED MODEL INVESTIGATION OF TAICHUNG HARBOR, TAIWAN, REP. OF CHINA,
Florida Univ., Gainesville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10427

COASTAL MOBILE BED MODEL - DOES IT WORK,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10428

MULTILAYER HYDRODYNAMICAL-NUMERICAL MODELS,
Naval Environmental Prediction Research Facility, Monterey, Calif.
For primary bibliographic entry see Field 2L.
W76-10429

MULTI-PHASED MODEL STUDY OF THE SETO INLAND SEA,
Chugoku Inst., of Industrial Technology, Kure (Japan). Hydraulic Research Section II.
For primary bibliographic entry see Field 2L.
W76-10430

TIDAL RESIDUAL CIRCULATIONS IN THE HYDRAULIC MODEL,
Ehime Univ., Matsuyama (Japan). Dept. of Ocean Engineering.
For primary bibliographic entry see Field 2L.
W76-10431

MODELING OF TURBULENCE IN THE SURF ZONE,
Technische Hogeschool, Delft(Netherlands). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10432

NEARSHORE WATER CIRCULATION INDUCED BY WIND AND WAVES,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10433

NUMERICAL MODEL FOR WAVE REFRACTION BY FINITE AMPLITUDE WAVE THEORIES,
California State Univ., Long Beach. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10434

SCALE EFFECTS ON PHYSICAL/MATHEMATICAL MODELING,
Hawaii Univ., Honolulu. Dept. of Ocean Engineering.
T. T. Lee.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1101-1120, 1975. 20 fig, 22 ref.

Descriptors: *Model studies, *Mathematical models, *Hydraulic models, Harbors, Waves(Water), Inlets(Waterways), Channels, Ships, Loads(Forces), Estuaries, Ocean waves, Hydraulics.
Identifiers: *Scale effects, Wave forces.

Model and scale effects on physical and/or mathematical modeling were discussed. The objective was to disclose some pitfalls based on the direct experience of the author. Subjects included: (1) Wave Characteristics in Harbor. Scale effects on wave attenuation in model due to viscous damping (bottom friction) were discussed in determining the scale of hydraulic model. Scale effect on multiple waves was considered. The effects of wave gage locations on the maximum wave height in the harbor were described. Model effects on the seiche period displacements were evaluated based on experimental, mathematical and field measurements. The effect of training-walls in the model on these parameters was described. (2) Inlet Channel Stabilization. Special emphasis was placed on the uses of three model scaling criteria for a movable-bed, estuary model. These involved calibration of the model by comparing the sediment deposition in the entrance channel with the prototype and model results. The effects of model sediment characteristics on the time scale of bottom evolution were discussed. (3) Wave Forces on a Pile. Discussions were made on the errors in the prediction of wave forces due to discrepancies in the prediction of free surface profiles, wave kinematics, drag and inertia coefficients by using linear, Stokes Third and Fifth Order wave theories. (4) Impact Forces, Mooring Forces, and Ship Motions of a Supertanker. The limitations of both mathematical and physical modeling were given. The effects of hydrodynamic mass and damping coefficients on the unit amplitude response operators show significant discrepancies in physical and mathematical modeling. (See also W76-10415) (Sims-ISWS)
W76-10435

TIME-DEPENDENT MASS DISPERSION IN NATURAL STREAMS,
Dames and Moore, Bethesda, Md.
For primary bibliographic entry see Field 5B.
W76-10436

SCALING AND SIZING CRITERIA FOR THERMAL-HYDRAULIC MODELS,
Acres Consulting Services Ltd., Niagara Falls (Ontario).
For primary bibliographic entry see Field 5B.
W76-10437

APPLICATION OF A WATER QUALITY MODEL TO THE DENVER METROPOLITAN AREA,
Black and Veatch, Denver, Colo.
For primary bibliographic entry see Field 5B.
W76-10438

COMBINED USE OF PHYSICAL AND MATHEMATICAL MODELS FOR ANALYSIS OF RESERVOIR WATER QUALITY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
For primary bibliographic entry see Field 5B.
W76-10439

APPLICATION OF A DYNAMIC NETWORK MODEL TO HYDRAULIC AND WATER QUALITY STUDIES OF THE ST. LAWRENCE RIVER,
For primary bibliographic entry see Field 5B.
W76-10440

FINITE DIFFERENCE APPROXIMATION TO THE CONVECTIVE TRANSPORT EQUATION,
Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
For primary bibliographic entry see Field 5B.
W76-10441

MEASURED CONTRIBUTIONS OF THE TERMS OF THE VERTICALLY INTEGRATED HYDRODYNAMIC EQUATIONS,
Delta Service, Rijkswaterstaat (Netherlands).
For primary bibliographic entry see Field 2L.
W76-10442

SIMULATION OF THE SALINITY DISTRIBUTION IN THE ST. LAWRENCE ESTUARY BY A TWO-DIMENSIONAL MATHEMATICAL MODEL,
Laval Univ., Quebec. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W76-10443

OVERVIEW OF PHYSICAL ESTUARY PRACTICE,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
For primary bibliographic entry see Field 2L.
W76-10444

COMPARISON BETWEEN PHYSICAL AND MATHEMATICAL MODELLING OF A TIDAL FJORD SYSTEM IN NORTHERN NORWAY,
Trondheim Univ. (Norway). Vassdrags- og Havnelaboratoriet.
For primary bibliographic entry see Field 2L.
W76-10445

COMPARISON OF HYDRAULIC AND NUMERICAL TIDAL MODELS,
Naval Postgraduate School, Monterey, Calif. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W76-10446

MODELING SEDIMENT DEPOSITION IN A TIDAL RIVER,
Dames and Moore, Cranford, N.J.
For primary bibliographic entry see Field 2L.
W76-10447

COMPUTER SIMULATION OF BEACH EROSION AND PROFILE MODIFICATION DUE TO WAVES,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W76-10448

MODELLING OF SUSPENSION CURRENTS,
Trondheim Univ. (Norway). Vassdrags-og Havnelaboratoriet.
For primary bibliographic entry see Field 5B.
W76-10449

ANALYTICAL MODEL OF DUCT-FLOW FLUIDIZATION,
Scripps Institution of Oceanography, La Jolla, Calif.
J. A. Bailard, and D. L. Inman.
In: Symposium on Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1402-1421, 1975. 7 fig, 2 tab, 4 ref.

Descriptors: *Model studies, *Sands, *Excavation, Dredging, Mathematical models, Laboratory tests, Pipes, Flow, Fluid mechanics, Hydraulics.
Identifiers: *Duct-flow fluidization, Sand transport, Fluidizing pipes.

An analytical model of the duct-flow fluidization technique for transporting sand was developed, using unidirectional flow theory. Dimensionless pressures and velocities were obtained from the numerical solution of six difference equations and three boundary conditions. Preliminary laboratory tests were made of a 6.1 m long fluidizing pipe oriented both horizontally and with a 3 degree downward slope. The good agreement between experiment and theory suggested that the model provides a basis for further development of this method of sand transport. The model showed that for similar flow conditions, the length of unvented duct-flow increases with increasing thickness of overburden. (See also W76-10415) (Sims-ISWS)
W76-10450

PROBLEMS OF PHYSICAL MODEL TESTS WITH HARBOURS,
Danish Hydraulic Inst., Copenhagen.
H. Gravesen, J. Kirkegaard, and A. H. Nielsen.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1422-1447, 1975. 20 fig, 3 ref.

Descriptors: *Model studies, *Harbors, *Waves(Water), Ocean waves, Hydraulic models, Coastal engineering, Coastal structures, Ships, Laboratory equipment, Laboratory tests, Hydrodynamics, Hydraulics.
Identifiers: *Harbor models.

A description was presented of the experience gained on the following subjects by using the Danish Hydraulic Institute (DHI) method for model tests with harbor facilities: (1) evaluation of the experience from existing harbors, (2) evaluation of the requirements to site wave recordings, and (3) methods for selecting the critical wave situation. The wave generators at DHI consist of a hydraulic servosystem, which gives a vertical wave paddle a horizontal translational movement. The position of the paddle is controlled by an electric signal from the 'Wave Function Generator' (WFG). The control signal is generated on the basis of a punched tape record of nature waves. This digital record is converted to an analog electric signal, which after integration over time is fed

into the servosystem of the wave generator. The mean period of the model wave train is controlled by the reading speed of the punched tape, and the amplification in the WFG determines the wave heights. Wave disturbance tests carried out at the DHI with irregular waves have provided strong indications of the superiority of irregular wave tests over regular wave tests. Results from the model tests have been compared with simultaneous recordings in the nature of waves outside and inside the Hanstholm harbor. The comparison indicated that the irregular wave model represents a good reproduction of the prototype. (See also W76-10415) (Sims-ISWS)
W76-10451

FINITE ELEMENT MODEL FOR BACKWATER COMPUTATION,
Office of the Chief of Engineers (Army). Washington, D.C.
M-T. Tseng.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1448-1466, 1975. 7 fig, 1 tab, 11 ref.

Descriptors: *Model studies, *Flood plains, *Bridges, Mathematical models, Water levels, Floods, Highways, Embankments, Streamflow, Rivers, Finite element analysis, Analytical techniques, Bridge design.
Identifiers: *Bridge backwater.

A mathematical model describing the steady, two-dimensional subcritical flow in wide, heavily vegetated flood plains of bridge waterways has been developed using the finite element method. The flow equations were solved simultaneously by numerical methods to yield the spatial distribution of water surface elevations and velocities within the flow region for prescribed boundary conditions. Galerkin's method of weighted residuals has been applied to the basic differential equations to form the finite element representation. The element shape selected for the model was the triangle, with quadratic shape functions defined for unit flows and linear shape functions defined for the depth. Flow simulations for normal, skewed and eccentric type of stream crossings can be performed by the model. Hydraulic computations for flow overtopping approach embankment and multi-bridge openings across a stream valley can be carried out without requiring prior assumption of flow distribution for each bridge opening. (See also W76-10415) (Sims-ISWS)
W76-10452

TWO-DIMENSIONAL FINITE ELEMENT DISPERSION MODEL,
Dames and Moore, Cranford, N.J.
For primary bibliographic entry see Field 5B.
W76-10453

FLOW2D: A TWO-DIMENSIONAL FLOW MODEL FOR FLOOD PLAINS AND ESTUARIES,
Resource Analysis, Inc., Cambridge, Mass.
For primary bibliographic entry see Field 2L.
W76-10454

ANALOGOUS MODELLING OF AQUIFEROUS SYSTEMS IN COASTAL ZONES,
Akademiya Nauk SSSR, Moscow. Interagency Geophysical Committee.
For primary bibliographic entry see Field 2L.
W76-10455

NUMERICAL MODEL FOR STORM SURGE AND TIDAL RUN-UP STUDIES,
Dames and Moore, Los Angeles, Calif. Advance Technology Group.
For primary bibliographic entry see Field 2L.
W76-10456

NUMERICAL SIMULATION OF STORM SURGES IN BAYS,
Danish Hydraulic Inst., Horsholm.
For primary bibliographic entry see Field 2L.
W76-10457

WAVE INDUCED LOADS ON MULTI-ELEMENT STRUCTURES,
Scripps Institution of Oceanography, La Jolla, Calif.
R. J. Seymour.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1552-1567, 1975. 8 fig, 5 tab, 6 ref.

Descriptors: *Model studies, *Waves(Water), *Loads(Forces), *Breakwaters, Mathematical models, Hydraulic models, Structures, Hydraulic structures, Barriers, Harbors, Peak loads, Hydrodynamics, Fluid mechanics.
Identifiers: *Tethered float breakwaters, Mooring forces, Floating breakwaters.

A linearized mathematical model was derived for summing the wave induced mooring forces on a tethered float breakwater, a floating structure with a large number of identical compliant elements. This necessitated considering, in addition to the hydrodynamic loads on the structure elements, the transfer function for structural response to wide band random waves, the effects of energy attenuation within the structure and a spectral function for the phase relationships among the individual elements and the incident wave field. The theoretical model was tested at large laboratory scale by subjecting a 4 meter long model breakwater to simulated random seas with actual peak energy periods ranging from 4 to 1.1 seconds. The measured load statistics were found to be in good agreement with those calculated by the mathematical model. It was further found that the peak load could be reliably estimated from knowledge of the incident wave spectrum. (See also W76-10415) (Sims-ISWS)
W76-10458

PORTABLE BREAKWATER WITH SHIP HULKS,
Dames and Moore, New York.
H. M. Noble, T. T. Lunde, and T. S. Winslow.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1568-1584, 1975. 8 fig, 2 tab.

Descriptors: *Model studies, *Breakwaters, Ships, Mathematical models, Hydraulic models, Scour, Sands, Erosion, Harbors, Waves(Water), Storms, Storm surge, Hydrodynamics, Australia.
Identifiers: *Botany Bay(Australia), Portable breakwaters, Ship hulks.

This paper describes the concept and modeling of two ship hulks bearing on a sand bottom to form a portable breakwater to provide temporary protection from ocean waves for construction of a tribar-covered revetment at the entrance to Botany Bay, Australia. Stability of the breakwater to resist sliding and overturning without exceeding local bottom bearing pressure from incident wave action was analyzed mathematically by a computer program. Four hydrodynamic model tank tests were run to analyze effects and extent of bottom foundation scouring. These tests included the study of scour prevention by use of an anti-scour cloth cover placed over the sand bottom in vicinity of hulk bottoms. Modeling proved anti-scour cloth successfully prevented bottom scouring. (See also W76-10415) (Sims-ISWS)
W76-10459

ANALYSIS OF FLOATING BREAKWATER PERFORMANCE,
Washington Univ., Seattle. Dept. of Mechanical Engineering.
B. H. Adee.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1585-1602, 1975. 9 fig, 4 ref, 1 append.

Descriptors: *Model studies, *Breakwaters, *Waves(Water), Mathematical models, Hydraulic models, Harbors, Marinas, Hydraulics, Hydrodynamics.
Identifiers: *Floating breakwaters, Transmission coefficients.

A two-dimensional-linear theoretical model has been developed which can predict the performance of floating breakwaters of arbitrary cross-sectional shape, including catamarans. This theory was applied to various breakwaters of different shapes and results were compared with measurements from the model tank and prototype installation in the field. These results indicated that the theoretical model may be very useful as a design and research tool and where additional development of the theoretical model is required. (See also W76-10415) (Sims-ISWS)
W76-10460

RELIABILITY OF RUBBLE-MOUND BREAKWATER STABILITY MODELS,
R. Y. Hudson, and D. D. Davidson.
In: Symposium On Modeling Techniques, Volume II; 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975. American Society of Civil Engineers, New York, p 1603-1622, 1975. 6 fig, 14 ref.

Descriptors: *Model studies, *Breakwaters, *Waves(Water), Hydraulic models, Structures, Structural stability, Structural analysis, Stability, Structural design, Structural models, Hydraulics, Fluid mechanics, Hydrodynamics.
Identifiers: *Rubble-mound breakwaters.

The design of rubble-mound breakwaters to withstand the forces of wave action, in such a way as to obtain safe and economical structures, is difficult. It is usually necessary to conduct scale-model investigations to determine the optimum design. The lack of data for postconstruction verification of such models is sparse because of the difficulty and cost of obtaining such data, the extended time required for observation of prototype structure performance, uncertainty of the prototype wave climate that the structure was actually subjected to, and oftentimes changes in final design subsequent to model tests. The objectives of this paper were to explain the basis upon which rubble-mound stability models are designed, constructed and operated, and to provide information from which the accuracy of such models can be obtained. Comparisons were made between model tests at various scales and between some specific prototype structures and scale model tests performed of these structures. It was concluded that hydraulic scale models can be used to determine the stability of rubble-mound breakwaters against wave attack, and that the accuracy of test results will be within the limits required to design safe and economical prototype structures provided the model is designed and operated properly and test conditions are selected judiciously. (See also W76-10415)
W76-10461

MODELING OF INLET-BAY SYSTEMS IN RELATION TO SAND TRAPPING,
Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
For primary bibliographic entry see Field 2L.
W76-10462

LCHF COASTAL SEDIMENT MODELING TECHNIQUES,
Laboratoire Central d'Hydraulique de France, Paris.
For primary bibliographic entry see Field 2L.
W76-10463

FLOATING STRUCTURE ARRANGEMENT,
For primary bibliographic entry see Field 8A.
W76-10465

8C. Hydraulic Machinery

WHAT TYPE OF RIG SHOULD YOU BUY,
R. B. McDannald.
Water Well Journal, Vol. 30, No. 6, p 30-31, June, 1976. 1 tab.

Descriptors: *Drilling, *Water wells, *Rotary drilling, Economic feasibility, Cost comparisons, Operation and maintenance, Operating costs.
Identifiers: *Cable tool drilling, Combination rigs, Employee training expense, Drilling efficiency, Effect of varying lithologies.

Two types of drilling systems are used by the majority of water well contractors today. One type is the percussion cable tool drill which drills by lifting and dropping a drill bit to break and loosen the material in the drill hole. The other type is the rotary drilling machine which uses a rotary bit with mud or air to carry away the cuttings. There is a third type of drilling rig which combines both the percussion and rotary methods to drill. This is called a combination rig. The cable tool rig is the least expensive to purchase while the combination rig is the most expensive. Other factors besides price should be considered by the prospective rig buyer. The operating expense, spare parts, number of drillers' helpers and the life expectancy of the rig should all be researched and considered. Each drilling system offers advantages and disadvantages of it's own. A driller must consider the system that offers the best balance of purchase and operating cost, and features that fit his needs and operating perameters. (Heiss-NWWA)
W76-10094

RUN DRILL PIPE SLOWER AND REDUCE FORMATION DAMAGE,
Louis Records and Associates Inc., Lafayette, La.
For primary bibliographic entry see Field 8G.
W76-10097

EXXON USES HANDS-ON METHODS TO TRAIN DRILLING PERSONNEL,
Exxon Co., New Orleans, La.
For primary bibliographic entry see Field 8G.
W76-10098

HOW TO GET THE MOST FROM MUD PUMP PARTS,
Reed Tool Co., Houston, Tex.
For primary bibliographic entry see Field 8G.
W76-10112

HOW TO AVOID DOWNHOLE FAILURES AND MAXIMIZE PIPE USE,
AMF Tuboscope, Inc., Houston, Tex.
For primary bibliographic entry see Field 8G.
W76-10114

SEWER PEST CONTROL CHECK VALVE,
B. Diaz.
United States Patent 3,955,596. Issued May 11, 1976. Official Gazette of the United States Patent Office, Vol. 946, No. 2, p 560, May, 1976. 1 fig.

Descriptors: *Patents, *Sewers, *Valves, :pipes, *Flow control, Screens, Mechanical equipment, Outlets.

A valve section for sewer pipe was patented. It has a pipe portion having opposite circular ends to interconnect with adjoining pipe sections and a housing extending upward from the midportion of the pipe portion with an open top that has a removable cover. A lower end of the pipe portion has an interior shoulder. The valve support frame, which rests on this shoulder, can be removed vertically through the open top. A one-way flapper valve pivotally mounted on a horizontal axis in the frame connected from it into the pipe portion, swinging from a normal closed position that obstructs reverse sewage flow to a position responsive to flow of material towards a sewer outlet. A rod is upstanding from the frame. A screen upstream of the valve is mounted in the housing to move vertically from a normal raised inoperative position in the housing to the operative lowered position in the pipe portion. Disengageable linkage means act between the rod and screen to secure the screen in the raised position when the frame rests on the shoulder and are disengaged to release the screen for lowering to the operative position when the valve and frame are removed to clean the pipe. (Snyder-FIRL)
W76-10199

8E. Rock Mechanics and Geology

PREDICTING PRODUCTIVE TRENDS RELATED TO WRENCH FAULTS,
Exxon Production Research Co., Houston, Tex.
T. P. Harding.
World Oil, Vol. 182, No. 7, p 64-69, June, 1976. 7 fig, 6 ref.

Descriptors: *Faults(Geology), *Fractures(Geology), *Rock mechanics, *Structure, Oil wells, California, Foreign countries.
Identifiers: *Wrenching deformation, Enechelon folds, Strike-slip faults, Los Angeles basin, San Joaquin Valley(Calif), Venezuela, Sumatra.

Wrenching deformation is inherently effective in producing hydrocarbon traps and perhaps more than any other type structuring-readily lends itself to the prediction of major oil-play trends, and patterns of their individual prospects. Predictability derives from the systematic areal distribution of compressive and extensional forces along finite, linear zones of deformation. Different play patterns arise as a result of the interaction of three factors: (1) Magnitude or evolutionary stage of wrench faulting, (2) Gross geometry of regional deformation, (3) Structural response within deformed terrain. A number of major producing areas have been developed using this criteria including the California basins, certain North American Mid-Continent areas, as well as Venezuela and Sumatra. (Heiss-NWWA)
W76-10100

WATER WELLS AS POSSIBLE INDICATORS OF TECTONIC STRAIN,
Tokyo Univ. (Japan).
For primary bibliographic entry see Field 8G.
W76-10105

8G. Materials

FLOATING STRUCTURAL PLASTIC TRUSS SYSTEM PROTECTS WASTE LAGOON LINING,
FMC Corp., San Jose, Calif.
For primary bibliographic entry see Field 5G.
W76-10007

FIELD RESEARCH AND TESTING OF A WATER HAND PUMP FOR USE IN DEVELOPING COUNTRIES,
Battelle Columbus Lab., Ohio.
R. D. Fannon.
Final Research Report to Agency for International Development, 43 p., January 31, 1975, 2 fig., 4 tab.

Descriptors: *Pumps, Research and development, *Pump testing, Deep wells, Shallow wells, Rural areas.
Identifiers: *Hand pumps, *Field research and testing, *Developing countries, Thailand, Nigeria, Bangladesh.

Discussion between the Agency for International Development (AID) and the Battelle-Columbus Laboratories (BCL) resulted in a field research program to develop and test a water hand pump for use in developing countries. The basic requirements for a dependable and durable pump were (1) low production cost, (2) long life under severe conditions, and (3) easy to maintain with simple tools and unskilled labor. Two pump types, shallow well, and deep well were designed. The deep well pump having the cylinder separate from the pump body and submerged below the pumping water level. Both pumps were assembled from a few basic, interchangeable parts. These parts being: handle, cap, fulcrum, body, cylinder, stand, plunger assembly, valve assemblies, nuts and bolts. General pump design provided for ease of pumping from deep and shallow wells by varying the handle length and cylinder size. Every effort was made to keep the handle force below 40 pounds to permit operation by women and children. Three test areas were designated; Thailand, Nigeria and Bangladesh. Complete sets of patterns, core boxes, two assembled demonstration pumps and supplies were sent to each country. Design adjustments were made during follow-up visits for problems encountered in each country. (Heiss-NWWA)
W76-10086

RECORDING EQUIPMENT BOOSTER.
Ground Water Age, Vol. 10, No. 9, p 19, 30-31, May, 1976. 4 fig.

Descriptors: *Drilling equipment, *Drill monitors, *Instrumentation, Boreholes, Logging(Recording), *Water wells, Florida.
Identifiers: *Drilling recorder, *Inclinometer, *Drilling rate, Drilling standards, Drill bit pressure, Alsay-Pippin Corporation.

Alsay-Pippin Corporation uses two types of recording devices, a borehole inclinometer and a drilling recorder. The inclinometer helps avoid wear on tool joints and the drill string. In the case of drilling through a cavern an inclinometer will insure penetration of the floor directly below the entrance hole. The inclinometer is essential in drilling large diameter wells due to the fact that large diameter casing will not bend. The other recorder used by Alsay-Pippin is a recorder which measures drilling rate and bit weight. The recorder provides a record of penetration rate through a particular formation as well as the penetration rate per drilling shift. The weight required on the bit indicates the lithology of the formation, and helps control bit wear. (Heiss-NWWA)
W76-10091

PITLESS UNIT AND ADAPTER UPDATE.
Ground Water Age, Vol. 10, No. 9, p 25, 38-39, May, 1976.

Descriptors: *Water wells, Equipment, Administrative agencies, Design standards, Sanitary engineering, *Well regulations.
Identifiers: *Pitless adapters.

Many sanitarians and county agents are not aware of the variety of styles and sizes of pitless adapter equipment available. The last time an intensive, broad study of state regulations regarding pitless adapters and units was made by the WSC Pitless Adapter Division in 1973. At that time all states did not respond. Most of the states have a confusing variety of regulations, semiregulations, and nonregulations. Some state publications refer specifically to adapters, while others talk only generally about how the well should be completed. Some state codes use language which indicates that well pits 'Aren't very good' and then proceed to tell how a pit should be constructed. In nearly every area of the country pitless adapters and units are installed and in the vast majority of cases are approved. Pitless adapters do the sanitary job. (Heiss-NWWA)
W76-10092

WHAT TYPE OF RIG SHOULD YOU BUY,
For primary bibliographic entry see Field 8C.
W76-10094

CORROSION,
Plummer and McDannald Co., Galena, Ohio.
R. B. McDannald.
Water Well Journal, Vol. 30, No. 7, p 30-31, July, 1976. 1 tab.

Descriptors: *Corrosion, *Chemical reaction, *Well casings, Damages, *Corrosion control, Wells, Ground water, Well screens, Pumps.
Identifiers: *Corrosion damage, Corrosion damage cost, Galvanic series.

Corrosion is a natural electro-chemical errosive process which causes billions of dollars damage each year. Corrosion in water wells can limit their useful life. Commonly, damage suffered by water wells are: (1) Failure by corrosion of steel fittings in the pumping system, (2) Holes corroded through steel shells and cast housings of submersible pumps, (3) Well screen slot enlargement, followed by pumping of sand, (4) Strength reduction of casings and screens, leading to collapse, and (5) Redepositing of corrosion products on pump inlet screens and well screens, reducing flow. Generally corrosion takes place between metals of different chemical reactivities according to the galvanic series. Corrosion problems may be circumvented by a careful selection of metals with similar reactivities which will not corrode by close contact. (Heiss-NWWA)
W76-10095

RUN DRILL PIPE SLOWER AND REDUCE FORMATION DAMAGE,
Louis Records and Associates Inc., Lafayette, La.
L. Records.
World Oil, Vol. 182, No. 7, p 83-84, June, 1976. 5 fig, 1 ref.

Descriptors: *Drilling equipment, *Boreholes, Drilling fluids, Measuring instruments.
Identifiers: *Surge pressure, *Formation damage, Stand-per-minute rates, Surge-Swab Director, Drilling well control, Incorporated.

Running drill pipe into a well at excessive speeds induces significant surge pressures that can lead to damage of the formation being drilled. Causes of formation damage are varied, but generally are regarded as exposure of the formation to conditions that change its natural fluid content for some distance from the well bore. To circumvent this condition minimum weight drilling fluids are used as often as practical. Excessive downhole surge pressures can also be caused by high stand-per-minute rates of drill pipe running. The maximum surge pressure magnitude is determined by the length and size of the drill string lowered into the hole, properties of the drilling fluid, hole size and the maximum moving speed of the drill string. Drill string running speeds are measured using a Surge-Swab Director which gives an instantaneous readout of pipe speed in both feet per minute and seconds per stand. The unit is equipped with an alarm which sounds when pipe speeds reach excessive values. A strip chart recorder records the maximum speed of drill pipe going into the borehole. Careful monitoring of the drilling fluid condition and the Surge-Swab Director can preclude formation damage by excessive surge pressure. (Heiss-NWWA)
W76-10097

EXXON USES HANDS-ON METHODS TO TRAIN DRILLING PERSONNEL,
Exxon Co., New Orleans, La.
J. B. Day.
World Oil, Vol. 182, No. 7, p 95-98, June, 1976. 1 fig, 1 ref.

Descriptors: *Training, *Drilling, Drilling equipment, Wells.
Identifiers: *Hands-on training, *Blow-out preventer equipment, *Well control.

The hands-on concept of training can be applied effectively in teaching well control techniques and in gaining familiarity with equipment. Exxon Company, USA conducts two hands-on training seminars - 'Blow-out Preventer Equipment Systems' and 'Well Control'. Drilling superintendents, technicians and engineers trained by the hands-on method have confidence in the application of well control techniques and in the use of the equipment when faced with well control situations. (Heiss-NWWA)
W76-10098

SELECTING PACKER FLUIDS: HERE'S WHAT TO CONSIDER,
Delta Mud and Chemical Co., Houma, La.
D. J. Chauvin.
World Oil, Vol. 182, No. 7, p 87-91, June, 1976. 3 fig.

Descriptors: *Drilling fluids, *Brines, *Clays, *Slurries, *Emulsions, *Corrosion control, Economic life, Environmental effects, Physical properties, Chemical properties.
Identifiers: Packer fluid, Contaminant control, Formation damage control.

Every packer fluid in use today has specific advantages and disadvantages inherent to their physical and chemical composition. Selection of a packer fluid for a job can be simplified by using a checklist of requirements to satisfy the permameters of the job. The twelve most important requirements of a packer fluid are: (1) Density-how much density is necessary, (2) Minimum corrosion level-both corrosio rate and type should be considered, (3) Circulatability- packer fluids become so viscous with time, temperature and pressure that they cause expensive workovers, (4) Contaminant resistance, (5) Carrying capacity-the capability of carrying metal and cement cuttings during workover, (6) Formation damage prevention-the fluid should not be detrimental to production, (7) Economics-the packer fluid should be low in cost, both initial and long term, (8) Low Solids-material which fails to remain in suspension can settle and jam packers or tubing, (9) Drilling fluid application flexibility, (10) Availability, (11) Safe to work with, (12) Environmentally safe. (Heiss-NWWA)
W76-10099

TUBING-CASING RECLAMATION SAVED SHELL OVER $3 MILLION,
Shell Oil Co., New Orleans, La.
F. G. Smith.
World Oil, Vol. 182, No. 7, p 79-81, June, 1976. 3 fig, 1 tab, 6 ref.

Descriptors: *Drilling equipment, *Quality control, Evaluation, Test procedures, Corrosion control, Mechanical damage, Measuring equipment, Louisiana.
Identifiers: *Well casing, *Well tubing, *Reclamation program(Wells), Commercial inspection companies, Gulf coast.

Significant savings have resulted from Shell Oil Company's closely supervised tubing/casing inspection and reclaiming program initiated recently in the Louisiana Gulf Coast. During 1975, 2.3 million feet of tubing and casing were recovered at an estimated savings of 3.6 million dollars. During periods of tubular shortages the program permitted drilling and recompletion of many wells for which new pipe could not be purchased. The program also provided information on corrosion effects and past and future corrosion control methods. Data on typical mechanical damage was also collected. The key to the program was insistance on quality control from commercial inspection companies. Shell approached the problem by critical comparison of seven companies to judge if industry methods were adequate. Presently control is maintained primarily by certifying operators of commercial inspection equipment. (Heiss-NWWA)
W76-10101

HEAVY COLLARS AID HOLE CONTROL,
Shell Development Co., Houston, Tex.
W. B. Bradley, C. E. Murphey, L. L. Dickson, and R. T. McLamore.
Oil and Gas Journal, Vol. 74, No. 21, p 72, 75-76, 78-80, May 24, 1976. 9 fig, 5 tab, 4 ref.

Descriptors: *Drilling equipment, *Drilling, *Boreholes, Drilling fluids, Well, Rotary drilling.
Identifiers: *Heavy drill collars, *Borehole deviation, *Penetration rates, Nonmagnetic properties, Surveying drill collar, Downhole motors.

A heavy, stiff-bottom drill collar can substantially improve deviation performance, theoretically increasing penetration rates by 50-100 percent in deviation-prone areas. In studying heavy metal collars in directional drilling, these theoretical conclusions were reached: (1) Deviation performance can be increased by adding a limited length heavy-metal bottom drill collar, (2) Penetration-rate increases of 50-100 percent can be achieved without sacrificing hole angle in deviation-prone areas where the weight response is reasonably linear, (3) Alternately, the hole-angle dropping rate can be substantially increased, (4) The deviation-controlling advantages of a heavy-metal collar increase with increasing mud weight, (5) The nonmagnetic properties of some heavy-metals may allow the heavy-metal drill collar to also be used as a surveying drill collar, (6) Costs for the heavy-metal collar are comparable with other drill-string hardware such as nonmagnetic drill collars and down-hole motors. Therefore, no unreasonable risk is incurred by use of heavy-metal drill collars. (Heiss-NWWA)
W76-10102

WELL FIELD MAINTENANCE AVOIDS CRISES,
Moody and Associates, Inc., Columbus, Ohio.
H. B. Eagon.
Opflow, Vol. 2, No. 4, p 1, 4-5, April, 1976. 3 fig.

Descriptors: *Water wells, *Well spacing, *Water management(Applied), *Groundwater, Specific capacity, Aquifers, Economic efficiency, Data collections, Hydrogeology, Environment.

Identifiers: *Well fields, *Well field maintenance, Operation guidelines, Rating curves, Well redevelopment.

Many organizations fall short in regard to management and maintenance of a well field system after installation. A crises situation could develop within the system because many factors affecting its operation change with time. Ground water is a dynamic, not a static, resource. Sudden failure of a well is rare. A water well loses capacity slowly, giving ample time to detect this deterioration and plan corrective action. Establishment of baseline data and analysis of changes over a period of years is essential to diagnose a problem or predict the probable occurance of one. Development of a well field management program will guarantee the most efficient and economical operation and reliability of a well field. (Heiss-NWWA)
W76-10103

WATER WELLS AS POSSIBLE INDICATORS OF TECTONIC STRAIN,
Tokyo Univ. (Japan).
H. Wakita.
Science, Vol. 189, No. 4202, p 553-555, August 15, 1975. 2 fig, 10 ref.

Descriptors: *Water wells, *Observation wells, *Water level fluctuations, *Earthquakes, Faults, Seismic waves, Japan.
Identifiers: *Tectonic strain, *Coseismic water level changes, *Izu-Hanto-oki earthquake, Water well earthquake monitor.

Coseismic water level changes associated with the Izu-Hanto-oki earthquake of May 9, 1974, were recorded in 59 among 95 observation wells located in the districts of Tokai and Kanto, Japan. The spatial distribution of wells in which the groundwater level rose or fell was systematic. The area in which these wells are located closely coincide with the areas of contraction and dilatation expected by the faulting. This strongly suggests a possible correlation between the observed changes in groundwater level and the tectonic strain. The results may indicate that the water level of wells is able to monitor acute coseismic strain changes. (Heiss-NWWA)
W76-10105

HOW TO DRILL TROUBLESOME SHALES,
Dresser Industries, Inc., Houston, Tex. Magcobar Div.
N. Davis.
Drilling-DCW, Vol. 37, No. 9, p 33-34, June, 1976. 2 fig, 3 ref.

Descriptors: *Shales, Drilling, *Drilling fluids, *Potassium compounds, *Boreholes, Laboratory tests, Wells, Rocky Mountain Region.
Identifiers: Potassium chloride-polyacrylamide polymer-mud system, Sloughing shales, Water sensitive shales.

The potassium chloride, polyacrylamide polymer mud system has been successfully used in the Rocky Mountain area to drill a variety of hard, water sensitive, sloughing shales. Investigation of the hole problems indicate excessive hole erosion of the sloughing shales was caused by three main sources: Mechanical, chemical, and abnormal pressure - or a combination of each. Many times the driller was able to overcome the problems with additional mud weight or viscosity. When chemical or physical alteration of the shale occurred because of excessive stresses from water wetting by mud filtrate, the use of potassium chloride polyacrylamide mud system was successful in hole stabilization. Laboratory analysis of the clay content of the shale either by X-ray defraction or scanning electron microscope proved beneficial in assisting to correctly formulate the system. (Heiss-NWWA)
W76-10108

HOW TO MAKE YOUR DRILL STRING LAST LONGER,
Hughes Tool Co., Houston, Tex.
T. B. Smith.
Drilling-DCW, Vol. 137, No. 9, p 55-56, June, 1976.

Descriptors: *Drilling equipment, *Drilling, *Corrosion.
Identifiers: *Drill string wear, Abrasive wear, Torsional failures, Embrittlement failures, Washouts(Drilling), Slip damage.

Careful attention must be given to possible damage resulting from abrasive wear to the outside diameter of the drill pipe, torsional failures of pins or boxes, embrittlement failures, washouts or slip damage, as well as wear caused by normal everyday use. A basic step in problem solving is to state the problem clearly and completely; this may help in arriving at answers. List the ways in which drill strings wear out and/or fails: (1) abrasive wear of the outer surfaces, (2) torsional failures of pins or boxes, (3) hydrogen embrittlement failures, (4) washouts, (5) slip damage. Understanding of these drill string wear mechanisms and close visual inspection will do much to preclude drill string damage resulting from physical and chemical wear. (Heiss-NWWA)
W76-10109

HOW TO FREE A STUCK STRING,
GOTCO International, Inc., Houston, Tex.
M. W. Aulenbacher.
Drilling-DCW, Vol. 137, No. 9, p 37-38, 40, June, 1976. 4 fig.

Descriptors: Drilling, *Drilling equipment, *Wells, Equipment, Casings, Corrosion.
Identifiers: *Stuck drill string, *Fishing operations, Free point instrument, String shot machine, Taper tap, Circulating and releasing spear, Retrieving tool, Accelerator, Drill collars, Hydraulic jar, Bumper sub, Safety joint, Overshot tool, Internal cutter, Jet cutter, Chemical cutter.

One of the most serious cased hole fishing challenges is the stuck drill string. Remedial action must be immediately initiated to prevent formation invasion and/or mud dehydration in the borehole. The first pipe releasing technique is working the pipe in tension and circulation for a time. In many cases this procedure will free the string. The fishing operation begins with the location of the string sticking point, this is found using an electronic free point system. Back-off is then begun above the stuck point using a string shot. When the section is free it is sometimes possible to free the stuck fish by a powerful upward jar or by a steady high tensile pull. Washover operations may be necessary if jarring and pulling fails to release the fish. Other options are the use of an internal cutter, chemical cutter of jet cutter. Since each fishing problem is unique these methods can be modified to meet specific requirements of the job. (Heiss-NWWA)
W76-10110

HOW TO DRILL WITHOUT TROUBLESOME DOG-LEGS,
DRILCO, Houston, Tex.
G. E. Wilson.
Drilling-DCW, Vol. 137, No. 9, p 62, June, 1976.

Descriptors: *Drilling equipment, *Rotary drilling, Geologic formations.
Identifiers: *Dog-legs, *Borehole deviation, *Preventative methods, Packed hole assembly, Drill collars, Packed pendulum assembly, Bottomhole assemblies, Borehole stabilizers.

Perfectly vertical holes are virtually impossible to drill using the rotary method. Two logical theories have been stated as to the cause. One concerning the tendency a drill bit has to drill updip in formations with dips up to 40 degrees from horizontal. The other being that the bit can be deflected when weight is applied, due to the bending of the drill stem. Undersized holes and dog-legs can develop as a result of these conditions. The most commonly used methods for preventing crooked holes and dog-legs is the packed hole assembly with large diameter drill collars. A packed hole assembly will decrease the rate of hole deviation, but all assemblies will bend regardless of how stiff they are and angle deviation may still continue to build. In most instances the well will be drilled to a total depth without exceeding maximum deviation limits. When it becomes necessary to reduce inclination from vertical a packed pendulum assembly should be used. Careful study of geological conditions and proper selection of tools and assembly should prevent dog-legs in the borehole. (Heiss-NWWA)
W76-10111

HOW TO GET THE MOST FROM MUD PUMP PARTS,
Reed Tool Co., Houston, Tex.
E. Way.
Drilling-DCW, Vol. 137, No. 9, p 67-68, June, 1976. 3 fig, 2 tab.

Descriptors: *Drilling equipment, Drilling fluids, Maintenance, Hydraulic equipment, Hydraulic valves, Monitoring, Inspection, Reliability, Seals.
Identifiers: *Mud pumps, *Preventive maintenance, Pump valves, Flex lines, Wear gauge.

Mud pump malfunction and downtime is expensive and avoidable. Three groups of individuals, manufactures, contractors, and operators, are involved with mud-pump parts and have a role to play in insuring optimum operation of the pumping system. Attention cannot focus solely on specific pump parts but, rather, must look critically at suction and discharge conditions and equipment as well. Seals, flex lines, pump-input connections and suction lines, and discharge lines must be closely monitored for failure. A wear gauge will show wear better than other simple forms of inspection. Proper tools provided by pump-part manufacturers will extract maximum life at minimum cost from mud-pump parts. Accurate records of pump maintenance will reflect when and where pump part inspections should be made. Parts should be replaced with 'matching components' designed to fit specific mechanisms. These tools, parts and procedures will provide maximum operation life and minimum failure rate in mud pump systems. (Heiss-NWWA)
W76-10112

HOW TO PERFORM A THROUGH-TUBING GRAVEL PACK,
Dowell Div., Tulsa Okla.
D. G. Gurley, M. D. Bowman, and W. R. Landrum.
Drilling-DCW, Vol. 37, No. 9, p 28-30, June, 1976. 2 fig.

Descriptors: *Drilling, *Boreholes, *Wells, *Drilling equipment, Economic efficiency.
Identifiers: Through-tubing gravel pack, *Sand control methods(Wells), Well screen, Gravel packs, Well tubing.

Driller economics, accelerated by the need to produce all wells to their maximum, has created an emphasis on durable sand control systems which do not impair formation permeability. Through-tubing gravel packs are usually applied to wells which have produced for some time and which begin to show unacceptable amounts of sand in the produced fluid. The procudure is also applicable in wells with partial casing collapse or eroded perforations. A through-tubing gravel pack allows all the production packers and tubing to remain undisturbed and no expensive workover rig is required. In most instances the operation is performed with a snubbing unit with concentric tubing and special Dowell mixing and pumping equip-

ment. Gravel and screen selection are two of the most important aspects of designing a gravel pack for maximum productivity. Generally, the smallest gravel possible is used that will not restrict productivity. The most widely used screen for the process is 304 stainless steel, Keystone-shaped wire resistance-welded to stainless steel rods around the inner tubing. Low cost is a major advantage of through-tubing gravel packs over other sand control methods. The through-tubing gravel pack procedure is simple and straight forward. In most cases placement and pack can be performed in one day. (Heiss-NWWA)
W76-10113

HOW TO AVOID DOWNHOLE FAILURES AND MAXIMIZE PIPE USE,
AMF Tuboscope, Inc., Houston, Tex.
W. Rogers.
Drilling-DCW, Vol. 137, No. 9, p 61, June, 1976.

Descriptors: *Drilling equipment, *Inspection, *Quality control, Drilling, Corrosion, Nondestructive tests, Test procedures, Ultrasonics, Electronic equipment.
Identifiers: *Drill pipe, Service induced defects, Magnetic particle inspection.

The high cost of replacement pipe makes maximum use from drill pipe an economic necessity. Inspection can help maximize drill pipe usage and help avoid expensive downhole failures. AMF Tuboscope uses three separate procedures when inspecting drill pipe. Ultrasonic and visual inspection for service-induced defects in the pipe body, electronic end area inspection and magnetic particle inspection monitors the progression and severity of corrosion and/or service damage. The pipe is then classified and identified to customer or American Petroleum Institute-International Association of Drilling Contractors specifications. (Heiss-NWWA)
W76-10114

HOW TO USE A SYSTEMS APPROACH TO COMBAT LOST CIRCULATION,
K. Williams, and E. Williams.
Drilling-DCW, Vol. 137, No. 9, p 73-74, June, 1976. 2 fig.

Descriptors: *Drilling, Drilling fluids, *Boreholes, Geological surveys, Fractures(Geology), *Systems analysis.
Identifiers: *Drilling fluid additives, Lost circulation, Spinner surveys, Temperature surveys, Vugular formations, Unconsolidated formations.

The most effective and inexpensive method for stopping lost circulation is the Systems Approach. The system may consist of only one product or a number of products which when used together act synergistically. The use of the Systems Approach requires adequate information such as local drilling reports, spinner, temperature or radioactive surveys, history of the well field, evaluation of cuttings, geological surveys and well logs from nearby wells. The Systems Approach can be used for sealing fractured, vugular, or unconsolidated formations. (Heiss-NWWA)
W76-10115

HOW TO COPE WITH SULFIDE CORROSION,
D. Reynolds.
Drilling-DCW, Vol. 37, No. 9, p 31, June 1976.

Descriptors: *Corrosion control, *Hydrogen sulfide, Drilling fluids, Sulfates, Drilling equipment.
Identifiers: *Sulfide stress cracking, Hydrogen embrittlement, Thermal degradation, Hatch test, Garrett Gas Train, Corrosion coupons, Corrosion monitoring, Sulfide scavengers, Drill pipe, Copper carbonate, Zinc chromate, Zinc carbonate, Magnitite.

Hydrogen sulfide has been a source of great concern in the oil industry for many years; first as a safety program, but also as cause of sulfide stress cracking and hydrogen embrittlement. The primary source of hydrogen sulfide is produced fluids. However, it may also be produced by the thermal degradation of mud additives or bacterial degradation of sulfates. Methods such as the 'Hatch test', the Garrett Gas Train, acid arsenate, and drill pipe corrosion coupons are used for detection of hydrogen sulfide in drilling muds. The detection of hydrogen sulfide in a drilling fluid is a preliminary step in corrosion control. Next a corrosion control program must be implemented. Generally this consists of raising the mud to a pH of 11.5 with an oil soluble amine for spraying and slugging the drill pipe and a sulfide scavenger. Copper carbonate, zinc chromate, magnitite and zinc carbonate are materials which have been used as sulfide scavengers. (Heiss-NWWA)
W76-10116

HOW TO SAND FRAC MULTIPLE ZONE OPEN HOLE SECTIONS,
L. Sanford.
Drilling-DCW, Vol. 137, No. 9, p 41, June, 1976.

Descriptors: *Drilling equipment, *Fractures(Geology), Boreholes, Wells.
Identifiers: *Inflatable packer system(Wells), *Open-hole fracturing(Wells).

TAM International has developed an inflatable packer system which has been used in several open-hole fracturing operations, with results consistantly equal to cased hole jobs. The design and construction of this new packer allows significantly higher inflating pressures to be used, resulting in a surer packer seat in the hole. The new inflatable packer system is easily used for fracturing multiple zones in one operation. The key to the operation is the ease of which the packers are operated; that is, setting and retrieval. (Heiss-NWWA)
W76-10117

PRINCIPLES AND MEASURING TECHNIQUES OF TURBULENCE CHARACTERISTICS IN OPEN-CHANNEL FLOWS,
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 8B.
W76-10134

POLLUTION-FREE WELL CUTTINGS DISPOSAL APPARATUS,
NL Industries, Inc., New York. (Assignee).
For primary bibliographic entry see Field 5G.
W76-10464

METHOD FOR CONTROLLING SCALE,
Texaco Inc., New York. (Assignee).
For primary bibliographic entry see Field 5G.
W76-10469

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

CHEMICAL HAZARDS RESPONSE INFORMATION SYSTEM, A CONDENSED GUIDE TO CHEMICAL HAZARDS,
Coast Guard, Washington, D. C. Office of Marine Environment and Systems.
For primary bibliographic entry see Field 5A.
W76-10047

EFFECTS OF THERMAL AND CHEMICAL DISCHARGES FROM NUCLEAR POWER PLANTS,
Battelle Pacific Northwest Labs., Richland, Wash.
For primary bibliographic entry see Field 5C.
W76-10051

A REVIEW OF THE LITERATURE ON THE USE OF SIMAZINE IN FISHERIES,
Fish and Wildlife Service, LaCrosse, Wis. Fish Pesticide Research Unit.
For primary bibliographic entry see Field 5C.
W76-10052

CONSIDERATIONS ON THE EFFECTS OF HIGH TEMPERATURES ON ALGAE AND FISHES, A LITERATURE REVIEW, 1954,
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
For primary bibliographic entry see Field 5C.
W76-10055

POLLUTION EFFECTS ON SURFACE WATERS AND GROUND WATERS, (LITERATURE REVIEW),
Ontario Ministry of the Environment (Toronto).
For primary bibliographic entry see Field 5C.
W76-10104

CANADIAN PARTICIPATION IN THE INTERNATIONAL HYDROLOGICAL DECADE, FINAL REPORT, (VOLUME 2), RESEARCH REPORTS.
International Hydrological Decade, Ottawa (Ontario). Canadian National Committee.
For primary bibliographic entry see Field 2A.
W76-10489

INFORMATION BOOKLET FOR ICEREF, THE BIBLIOGRAPHY OF CANADIAN GLACIERS, GLACIER INVENTORY NOTE NO. 8,
Department of the Environment, Ottawa (Canada). Inland Waters Directorate.
For primary bibliographic entry see Field 2C.
W76-10494

10D. Specialized Information Center Services

NATIONAL WATER DATA STORAGE AND RETRIEVAL SYSTEM: INSTRUCTIONS FOR PREPARATION AND SUBMISSION OF GROUND-WATER DATA,
Geological Survey, Reston, Va.
C. H. Baker, Jr., and D. G. Foulk.
Open-file report 75-589, November 1975. 127 p, append.

Descriptors: *Data storage and retrieval, *Groundwater resources, *Hydrologic data, *Data processing, Methodology, Groundwater, Water wells, Aquifers, *Data collections.
Identifiers: *National Water Data Storage and Retrieval System(WATSTORE).

The Groundwater File of the Geological Survey's National Water Data Storage and Retrieval System (WATSTORE) contains physical, hydrologic and geologic data about sites where groundwater is, or can be, withdrawn from the aquifer, or sites where potential aquifers are exposed. This report, which pertains to the preparation and submission of data to the groundwater file, is the first of several reports that will explain the groundwater file. The present report is divided into four sections. Section A gives a brief description of the data bases, their logical and physical structure, the storage and retrieval mechanisms used, and the philosophy and methodology adopted for their maintenance. Section B describes the input forms, and gives detailed in-

structions for entering data on the forms in the field or office. Section C deals with the special input procedures and Section D gives instructions for key punching and processing data for input to the data bases. Five appendices contain sample forms and codes used in recording groundwater data and a discussion of input procedures. (Woodard-USGS)
W76-10148

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FLUIDIZED BED INCINERATION

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ARMY ENGINEER DISTRICT, SAN FRANCISCO, CALIF.

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W76-10010	5D	W76-10088	4B	W76-10166	4A	W76-10244	2J
W76-10011	5D	W76-10089	4B	W76-10167	4A	W76-10245	5D
W76-10012	5D	W76-10090	4B	W76-10168	3C	W76-10246	5D
W76-10013	5B	W76-10091	8G	W76-10169	3C	W76-10247	5D
W76-10014	5B	W76-10092	8G	W76-10170	3F	W76-10248	5D
W76-10015	5B	W76-10093	5G	W76-10171	5G	W76-10249	5E
W76-10016	5B	W76-10094	8C	W76-10172	2I	W76-10250	5G
W76-10017	5A	W76-10095	8G	W76-10173	3F	W76-10251	5D
W76-10018	5D	W76-10096	5G	W76-10174	5D	W76-10252	5F
W76-10019	5D	W76-10097	8G	W76-10175	2I	W76-10253	5B
W76-10020	5G	W76-10098	8G	W76-10176	3F	W76-10254	5D
W76-10021	5B	W76-10099	8G	W76-10177	3F	W76-10255	5D
W76-10022	5A	W76-10100	8E	W76-10178	2I	W76-10256	5D
W76-10023	5A	W76-10101	8G	W76-10179	3F	W76-10257	5D
W76-10024	5B	W76-10102	8G	W76-10180	5G	W76-10258	5E
W76-10025	5B	W76-10103	8G	W76-10181	4C	W76-10259	5A
W76-10026	5D	W76-10104	5C	W76-10182	2G	W76-10260	5D
W76-10027	5A	W76-10105	8G	W76-10183	4A	W76-10261	5A
W76-10028	5A	W76-10106	5G	W76-10184	2I	W76-10262	2G
W76-10029	5A	W76-10107	4B	W76-10185	2I	W76-10263	5B
W76-10030	5A	W76-10108	8G	W76-10186	3F	W76-10264	6E
W76-10031	5B	W76-10109	8G	W76-10187	3F	W76-10265	5B
W76-10032	5D	W76-10110	8G	W76-10188	5B	W76-10266	5C
W76-10033	5D	W76-10111	8G	W76-10189	3F	W76-10267	5C
W76-10034	5D	W76-10112	8G	W76-10190	5B	W76-10268	5C
W76-10035	5D	W76-10113	8G	W76-10191	5B	W76-10269	5B
W76-10036	5D	W76-10114	8G	W76-10192	6A	W76-10270	2D
W76-10037	5D	W76-10115	8G	W76-10193	6C	W76-10271	5B
W76-10038	5A	W76-10116	8G	W76-10194	4B	W76-10272	5C
W76-10039	5B	W76-10117	8G	W76-10195	5G	W76-10273	5B
W76-10040	5D	W76-10118	3F	W76-10196	4A	W76-10274	5B
W76-10041	5C	W76-10119	5D	W76-10197	5D	W76-10275	5C
W76-10042	5C	W76-10120	5C	W76-10198	5D	W76-10276	5B
W76-10043	5C	W76-10121	5C	W76-10199	8C	W76-10277	5C
W76-10044	5C	W76-10122	3F	W76-10200	5D	W76-10278	5C
W76-10045	5C	W76-10123	2H	W76-10201	5A	W76-10279	5C
W76-10046	6G	W76-10124	2L	W76-10202	5D	W76-10280	5C
W76-10047	5A	W76-10125	2I	W76-10203	5D	W76-10281	5C
W76-10048	5A	W76-10126	2J	W76-10204	5D	W76-10282	5C
W76-10049	5C	W76-10127	5C	W76-10205	5D	W76-10283	5B
W76-10050	5C	W76-10128	5D	W76-10206	5D	W76-10284	5C
W76-10051	5C	W76-10129	7C	W76-10207	5D	W76-10285	5C
W76-10052	5C	W76-10130	6E	W76-10208	5D	W76-10286	5C
W76-10053	5C	W76-10131	5A	W76-10209	5D	W76-10287	5C
W76-10054	5C	W76-10132	7C	W76-10210	5D	W76-10288	5C
W76-10055	5C	W76-10133	5A	W76-10211	5D	W76-10289	5C
W76-10056	5C	W76-10134	8B	W76-10212	5D	W76-10290	5C
W76-10057	5C	W76-10135	4C	W76-10213	5D	W76-10291	5B
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A. CENTERS OF COMPETENCE		
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